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IN ALL THEIR DEPARTMENTS.

## REPORT ON A PROPOSED PLAN FOR IMPROVING THE NAVIGATION OF THE RIVER MONDEGO, AND THE PORT OF FIGUEIRA, PORTUGAL.

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(With a Plate.)

THE principal cause of the filling up of the bed of the river Mondego may be ascribed to the embankments which have been thrown up on the alluvial grounds bordering that stream and its tributaries; whereby the tidal waters, which formerly spread over a large surface (now reclaimed), have been confined to the narrow channels of the rivers themselves; and these being insufficient to contain a body of water strong enough to oppose successfully the swell of the Atlantic Ocean at the mouth of the Mondego, the former has brought up, and deposited at the mouth of the river, a body of sand, which forms the present bar, and through which the river waters have not sufficient power to keep open a navigable channel.

No water for "back scour" can be obtained above the river Lavos: it is proposed, therefore, to throw a water-tight embankment  $\alpha$   $\beta$  across the east mouth of the river Lavos, to extend from the south-east angle of the Murraceira to the main land; another similar embankment  $c$   $d$  should be thrown across the northern mouth where it joins the Mondego, provided with sluices  $\pi$ , bearing at once upon the bar; thus large reservoir for the tidal waters would be formed, which might be employed as a scour in the following manner: the sluices  $\pi$  in the northern embankment should be opened throughout the flood-tide, so as to allow the waters to flow into the channel of the Lavos; at the commencement of ebb tide the sluices to be shut, and the water penned back, until the Mondego has fallen to two-thirds ebb, when, the sluices being opened, the whole body of water held in the Lavos may be let into the Mondego, and thus be brought to bear with great impetus directly upon the bar; which, at this period of the tide, and until the commencement of the flood, would have very little water on it to break the force of the current directed against it. By these means the passage of the river Mondego would be again open in its original channel.

Still further to improve the course of the river, a stone embankment might be thrown along its northern shore from  $F$  to  $G$ , which would have the effect of deepening and scouring the bed, and would give the current a regular flow to the bar; which it has not at present, as eddies are formed in the little bays, and between the quays of Figueira, which greatly obstruct the force of the stream.

An examination of the plan will show that a curved direction is given to the current, as indicated by the arrows: from the form of the bar it is evident that the swell of the Atlantic runs obliquely upon the mouth of the Mondego and the southern shore, by which means the stream of the river is thrown down in the same direction,

and a channel is kept open between the Cabadello and the bar. To attempt by any means to act against the force of the Atlantic by the power here at command, would be useless; but by following the course pointed out by nature, we may hope in a great measure to remedy the evils at present existing. The passage through the middle of the bar at  $I$  is seldom or ever practicable; indeed, it is never so but when the wind is from the S.E.; when the impetus then given to the water of the river may occasionally clear a passage through it; but if the improvements before described are carried out, it is very probable that the passage will close altogether, and a new channel be formed between it and the shore in the direction  $H$ .

The embankment  $c$   $d$  from the Murraceira to the Cabadello may be formed of earth as far as  $c$   $d$ , taken from the Murraceira, and on the Mondego side faced with stone obtained from the north shore of the river, but the remaining portion, from  $d$  to  $D$ , which is across the main channel of the Lavos, should be formed entirely of dry rubble stone at least four feet higher than high-water mark. In order to render this dam water-tight it will be also necessary to carry up a core of puddle in the centre, to the level of high-water at spring tides.

The embankment  $\alpha$   $\beta$  will be formed in a similar manner to the foregoing, and that from  $F$  to  $G$ , on the north shore of the Mondego, may be entirely of rough stone having a slope of 3 to 1 on the river side: this embankment will not require to be puddled, as it is merely employed to give a proper direction to the current of the river.

Should it be necessary to give access by water to the salt works in the Murraceira, it may be obtained either by erecting wharfs and making a new road on the south bank of the Mondego, or by constructing a lock which would allow boats to pass from the Mondego to the Lavos.

## AGRICULTURAL ENGINEERING.

(With a Plan and Sections, showing the Application of normal contours to the ordinary surveys of lands.)

NECESSITY FOR CORRECT MAPS—QUANTITIES OF LAND IN LEASES AND CONVEYANCES, SOMETIMES IN EXCESS OF THE TRUE QUANTITY—MORE FREQUENTLY, HOWEVER, THE QUANTITY IS GREATLY UNDER THE TRUTH—PROBABLE CAUSES OF THIS—NATURE OF HEDGE-ROWS AND FENCES IN DIFFERENT PARTS OF ENGLAND—ORIGIN OF HEDGES—ORIGIN OF STONE FENCES—VALUE OF MAPS FOR OBTAINING CORRECT IDEAS OF RELATIVE POSITION—FOR EFFECTING ALL KINDS OF IMPROVEMENT.

THE owner of an estate without a map is in the condition of one who, being assured by others of the amount of his riches, and the extent of his property, must take the truth of such statements for granted—seeing that he possesses within himself no power

either of confirming or disputing their accuracy. Even for the amount of land occupied by each of his tenants, he relies upon the evidence of tradition, handed down probably from a time when the land was worth less than one fourth of its value in these days, and when errors were consequently of comparatively small importance. The instances are not rare in which, at or near the expiration of a long lease, the farmer has thought proper to claim from his landlord the accumulated rent with which he had been charged for too great a number of acres. A case of this kind lately came under our own observation, where a farmer brought an action against his landlord for £400, this being the sum to which 20 acres of land more than the quantity actually contained in his farm had amounted during the term of his lease. The landlord had only a hand sketch of the property to oppose to this claim; the farmer had a regular survey, and he gained his cause. We mention this merely as one instance—those who are more conversant with the practice of our law courts, are no doubt acquainted with many similar cases. But at the same time, it is a fact well known to every surveyor, that if the farmer be overcharged in some few instances, the error is generally on the other side. The cases in which farmers are paying rent for too great a quantity of land, form, after all, a very trifling proportion compared with those in which they are paying rent for too small a quantity.

There is nothing more common than to find in every estate, in all parts of the country, numerous fields known locally by a name implying their magnitude, as "the four acres," "the seven acres," "the six acres," &c. Now, in nine such cases out of ten, it will be found that the field, when measured, contains more land than this local designation implies. The four acres will probably be five, the six acres will be seven, and the seven will be nine. We have often been particularly struck with this, in looking over the reference to recent surveys, where the quantities entered in the terrier are invariably much greater than the local name of the field would indicate. This may in a great measure be accounted for, by considering that the name of the field was probably bestowed at a time when a great part of it was lying waste, and when thick hedge rows, shaws, and brakes surrounding it on all sides, occupied a great part of that surface which an improved practice in farming has long since brought into cultivation.

Thus, where the boundaries of a field consisted 100 years ago of a thick belt of underwood, of tangled brambles, thistles, and the luxuriant undergrowth of a fertile but neglected soil, these are now replaced by narrow, regular, and neatly-trimmed hedges, which rarely occupy one fifth the space of the old encumbering boundaries. A very large portion of this country, particularly in the clay districts, was at one time covered by forests like those of North America, New Zealand, and all newly-discovered countries.

The first clearings of this woodland were of course very imperfect; and hence in many cases a belt of ten, twelve, or more yards in breadth was left surrounding every field throughout a large district of country. In many counties, all appearance of the ancient woods has now been eradicated, but a great deal of this has been effected within the last 100 years; and it is only natural and reasonable to suppose that, except where recent surveys have been made, the quantities of fields, traditionally handed down from one proprietor to another, have been determined when a very large proportion of the land, now under the plough or the sickle, was lying in a waste, unprofitable state, and consequently was not included in the quantity of land assigned to the field.

It is not too much to say, that one entire fourth of many fields has been in this way lost to the owners for many years; and it is therefore not surprising to find that many estates, when now surveyed, exhibit an extent of cultivated land often 20 or 30 per cent. in excess of that by which the land has been described in old settlements and conveyances. In many parts of England, particularly in Kent, Sussex, Hampshire, and parts of South Wales, the ancient growth of wood remains in the thick hedge-rows to this day. These hedge-rows, in fact, have never been planted; there is no trace of either ditch or quicksets to be seen about them; they consist entirely of a broad belt of underwood, chiefly of hazel and ash, with some oak timber, which remains at this day the only representative of the stately, interminable forests which covered the rich wealds of our Saxon ancestors.

Every year, however, diminishes the dimensions of these belts, which are now of every intermediate breadth from 1 yard to more than 20, the majority, however, being not less than 10 to 12 yards. Every year the plough encroaches more and more upon the ancient growth; the timber is rarely allowed to acquire any size, so that the whole growth is reduced to that of underwood and saplings; and probably, in the course of another hundred years, the whole will be replaced by regular quickset hedges and ditches, which will thus give up many additional acres for profitable cultivation.

There are several fine estates in Sussex, where the proprietors within the last few years have stocked up every foot of the belts and shaws surrounding their fields, and substituted the modern hedge and ditch, an improvement from which they cannot fail to derive great advantages.

In many districts, the land was anciently covered with stones, as in the northern counties of England, also in Monmouth and Gloucestershire, where the conglomerate of the old red sandstone, scattered in great blocks over the country, prevents at this day the cultivation of large tracts of land. The process of clearing land from these stones, at first consisted in transporting them to long piles or heaps, many yards in breadth, and about 4 feet in height, which formed the first boundaries of the field. It may be argued from the crookedness of these primitive fences, that our ancestors had profited little by the military maxims of their Roman invaders, as they present a remarkable contrast to the undeviating straight lines in which that great people traced their roads across the most rugged, forbidding, and irregularly formed districts. In process of time, the surface of land covered by these huge masses, either of broken or boulder stones, which had been cleared from the fields which they bounded, came to be coveted by the cultivators of the land, so that, by degrees, the stones were carried away to form fences where they were not so abundant. Thus, the broad heaps of rough stone were in time reduced to neat margin walls of rubble masonry, seldom more than 4 or 5 feet in thickness, and often not more than a single foot. Now, in the case of land which has undergone this change, the same difference will be found between the ancient estimate of its quantity, and that which is now under cultivation, as we have already alluded to in speaking of the land bounded by natural shaws or belts. We have witnessed many stone fences in Gloucestershire several yards in thickness, and they have no doubt been originally much wider, as the proprietors, who in the district we allude to are mostly men of very small means, avail themselves of every possible opportunity to diminish the width of their truly unprofitable fences.

But, after all, the value of correct and modern surveys, in order

that a just relation may subsist between landlord and tenant, constitutes only a small proportion of that utility in all operations connected with the successful cultivation of land, which makes a correct map indispensable. No man can acquire so accurate and close an acquaintance with the position of different fields and different parts of the same estate, from merely walking or riding over it, no matter how long he may have been accustomed to do so, as from the contemplation of a map. In the latter, all the parts are concentrated—he holds in his hand a faithful picture of the whole district, perhaps many miles in length and breadth, correctly reduced into the space of a few square feet. He learns thus at one view the relative position of all his houses and outbuildings, gardens, homesteads, and fields; the exact figure of their boundary, and the roads which lead into them, and through them, out of the public or main roads, passing through the estate. He sees the disposition of the several farms, and of the lands included in each, and every facility is afforded for ascertaining at once whether any better disposition of these lands could be made by exchange or otherwise, or by adding to one farm and taking from another, for the mutual benefit of his tenants and himself.

From the map, he can ascertain at once the proportions of land subject to different kinds of cultivation, and producing the different varieties of crops; he can determine the quantities of waste land which might be brought into cultivation, and the quantities of useless land lying by the road sides, and occupied by green lanes which are never used. The forms and figures of fields are often very disadvantageous: in triangular fields, and those which have sharp angles at one or more of their corners, there is often a large piece of uncultivated waste, owing to the difficulty of ploughing it. Fields are often too small, and should be thrown into one, as being cheaper to plough and drill, and affording the additional land for cultivation which was occupied by the fences. Some fields, again, may be too large, and would be better divided. In effecting all these alterations, nothing is so great an assistance as a map, where the best means of making the proposed improvement is often seen at a single glance; and where this is not the case, it affords the best groundwork for scheming and considering different proposals for effecting the same object, and enabling the judgment to decide upon the best amongst them.

If any special works are to be executed for the improvement of the estate, as roads to be formed, ponds, reservoirs, mill-courses, canals, or drains to be cut, or streams to be diverted for irrigation or other purposes, the map in all such cases is indispensable, alike for developing the best means of executing the proposed work, and for furnishing the means of estimating its cost.

**RELATION OF RIVERS TO THE STRATA OVER WHICH THEY FLOW—  
THEIR BEDS AND VALLEYS ARE COMMONLY INDEPENDENT—DISTINCTION BETWEEN DILUVIAL AND ALLUVIAL DEPOSITS—THE FORMATION OF THE LATTER MAY BE AND SHOULD BE EXTENSIVELY IMITATED BY AGRICULTURISTS—PROCESS OF IRRIGATION—ITS EFFECTS—DRAINAGE—COMMERCIAL AND MANUFACTURING IMPORTANCE OF THE RUNNING WATER OF AN ESTATE.**

It has been truly observed, that the land-owners of this country are, even at this day, very imperfectly aware of the value of the water which falls upon their uplands in the form of rain and snow. The immediate effect of rain upon all kinds of vegetation is too obvious to escape notice, but it is important further to observe what becomes of the rain water, after it has performed this preliminary

office of affording nourishment to the leaves and roots of plants. In dry, open, porous soils, such as chalk and sand, the rain penetrates deeply into the ground, and insinuating itself through a thousand minute crevices and fissures, flows off in a series of subterranean channels of various forms and dimensions, sometimes opening into caverns or hollows, and sometimes spreading into wide and thin sheets, all in the interior of rocks, into which it has found its way from the surface of the ground. Into stiff, impermeable, tenacious soils, such as clays and marls, the rain water is incapable of penetrating to a great depth, and it therefore drains off the surface into numerous small streams, or rivulets, which seek their course along the lowest levels which the country affords. It follows from this, that districts of this latter character are commonly traversed by a great abundance of streams, and that, in addition, the whole of the soil is often saturated with moisture to such a degree, as to require effectual drainage before it can be cultivated to the greatest advantage. On the other hand, the open, porous soils are rarely watered by any streams, except those which flow in diluvial beds of clay, resting upon the general formation of the country. These diluvial beds have been originally formed by the same agency which first ploughed out the course of the river, at an era too distant for human chronology to record. Most of the great rivers, not only in England but in every other country, traverse in their course a great many different geological formations, amongst which are some so porous as to be incapable of holding or bearing water, however great the supply. But, on examining these districts, it will generally be found that the river is carried through them in a separate independent valley of clay, of greater or less breadth on each side of the river, according to the magnitude of the latter, and to the force of those disturbing causes which originally formed the channel. The Thames, the Severn, the Humber, and in fact all large rivers, afford numerous examples of this. The extreme fertility of the valleys in which they all flow, present, in some instances, a remarkable contrast to the barrenness of the neighbouring lands—a contrast produced by the superiority of the diluvial deposit of which these valleys are composed, and which, resting upon strata similar to those on each side, carry the river through, as it were, in a trough or open trunk, entirely separate from the porous strata beneath.

Diluvial deposits are attributed to causes which have long since ceased to exist, and they are in part assigned by Dr. Buckland to an era corresponding with that of the Mosaic deluge. These deposits have created vast tracts of highly fertile land in the valleys of all rivers, but the natural process by which this has been effected has been conducted on too great a scale ever to be successfully imitated by the puny efforts of man. It is not to the sudden convulsions of nature we must look for lessons to guide the application of human industry, but rather to those slow and quiet, and scarcely to be observed laws, according to which she is every hour putting in motion a variety of forces, and powers, and elements, which are capable of being turned to the use and convenience of mankind. It is, therefore, to the natural formation of alluvial soils that the attention will be most profitably and usefully directed. These formations are confined to no age and to no period. In every country, whether savage or civilized, whether waste or cultivated, there are abundant traces of alluvial action, continued through many distant ages, down to the most recent period of their observation. It is fair to conclude, therefore, that this action is constantly in progress, and will ever continue so till the end of

time. It remains to inquire what this action is, and how it can be imitated by man.

If we trace any great river to its sources through the intermediate course of many collateral branches, we shall find a great proportion of these originating in very minute and insignificant springs, which flow out just at the junction of some porous stratum with one of an opposite kind, on which it rests. Thus, where a range of sand or sandstone, which is permeable by water, rests upon a stratum of clay, which resists the penetration of water, the line of junction will be marked by the breaking out of springs, and the streams arising from these springs commonly flow off or away from the porous stratum, on and over the clayey or water-bearing soil, which has caused them to break out. At the very source of these streams, alluvial action commences; and through all the mazes of their course, until they swell from the tiny rivulet into the mighty river, and become an estuary of the sea itself, even to the margin of that sea, the alluvial action is never absent. Water, whether tranquil or in motion, always possesses the property of holding the constituents of certain soils, as clay and lime, in solution, and of chemically precipitating these when it comes in contact with certain other substances. This is one form of alluvial action from which deposits take place, and by which mixtures are produced of numerous earthy constituents with others existing in very different localities. Water, also, and particularly running water, is capable of carrying a certain proportion of solid matter in suspension, and whenever it becomes tranquil from any cause, a deposit of the suspended particles takes place, and this is another form of alluvial action. A third form, is that in which sand and pebbles are transported by the force of running water, and thrown up into banks and shoals on the margin of rivers and bays; but as this form does not appear to be readily applicable to any useful purpose in the cultivation of land, it will be unnecessary to enlarge upon it. The two first forms are highly important, however, because they lead to the very root of one of the fundamental principles in agriculture—that the most fertile soils result from the union of separate earths with each other. There are many examples by which this union is extensively effected by nature, not only in the valleys of rivers, but along the junction of different rocks, where one either abuts against, or passes under the other. Such lines of junction present commonly a zone of great fertility, the union of the soils composing it having resulted from the decomposition of one or both of the adjacent rocks.

To return, however to the subject of streams: it is found that those which flow from ranges of chalk and other limestones, over districts of heavy, stiff clay, carry with them a great quantity of calcareous matter, which, being deposited on the clay, adds very greatly to its fertility. In some districts, the chalky material brought down by streams is extensively used by the farmers as a dressing for their heavy clay lands. This is the case with the feeders of the Medway, which issue from the chalk about Oxted in Surrey. In many cases, the stream naturally flows in that direction where its fertilizing powers are most required, and therefore, any diversion of its course would be attended with no advantage. But, on the other hand, the stream very frequently takes its course in a direction which is not the most advantageous, as, for instance, where it flows over a soil composed of the same material as that which it carries with it in solution and suspension. Under these circumstances, it would be advisable to divert the course over a tract which requires a mixture of other soils to improve its fertility. There are many, many examples in every district, where the prin-

ciple here indicated may be carried out with great advantage. It embraces the theory of irrigation on the most extensive scale, and should be followed out in connection with an accurate observation of the constituents of different soils, and of the matters held in the waters of neighbouring streams. To enter into chemical considerations of this nature, would lead us too far away from the object of this paper, but we cannot avoid, however, glancing at the fact, that all running water is not of necessity fertilizing to a particular soil. Much depends upon the kind of rocks and earths through which it has passed, and particles of which, therefore, it carries with it. All this requires great attention and accurate knowledge on the part of the agriculturist; and, supposing him to have such knowledge, he cannot fail to observe numerous instances in which irrigation may be applied with great success.

A very important effect of irrigation is that of cleansing the roots of plants from a certain deposit of excrement which, greatly to their injury, has a tendency to form around the roots of all growing plants. All species of grasses are much improved by this cleansing of their roots.

To some it may appear that the process would be very slow and tedious, by which particular soils might be fertilized by a mixture with other earths carried down in streams; but in order to form correct notions on this subject, it is important to observe what actually happens in nature. Some idea, then, of the immense quantity of alluvial matter brought down by rivers, may be formed from an acquaintance with those immense tracts of marshes and flat land which surround the embouchure of most rivers. These lands are composed of alluvial soil, extending many feet in depth, not unfrequently as many as 20 or more feet of the richest soil, capable at once of supporting vegetable growth. It is probable, if these vast depositaries of rich mould could be transported from their present position, that they would suffice to cover over to the depth of several inches, the whole surface of the bare and naked downs and wastes of chalk and sand which remain uncultivated in so many parts of the country. The cost of transport, however, renders impracticable this method of bringing waste lands into cultivation, but at the same time it appears evident, that an immense deal might be done in the course of a few years by seizing, on its way to the sea, the vast quantity of alluvium which is daily carried down by all rivers. It must not even be supposed that the alluvial tracts we have spoken of at the mouths of rivers represent the complete amount of alluvium which has been brought down by the rivers, because, in addition to these, an immense proportion has been carried out to sea, and thus become lost to man, perhaps for countless ages to come. It should be the aim of every agriculturist, therefore, to arrest in every possible way the rapid waste and transport of alluvial matter, and although individual efforts may appear very inefficient to produce any great result of this kind, it must yet be obvious that a great number of individual efforts will produce a very great combined effect, and it is this effect which should be aimed at by every one who possesses the power and opportunity of aiding in it.

The preceding remarks on irrigation, and the distribution of alluvial soil over light and poor lands, apply principally to the open porous soils which are deficient in moisture at the surface of the earth, although they probably contain the greatest quantity of it at some depth beneath the surface, where they form the subterranean channels or conduits of the water, which, being first derived from rain, eventually breaks out in springs to form new rivers.

The next important connection which exists between the agriculturist and the water which is constantly passing through the strata composing the crust of the earth, arises from the necessity of draining the water out of certain kinds of soil which contain too much of it. Stagnant water produces no agricultural benefit, but is, on the other hand, just as injurious to vegetation as the entire absence of this element; hence, it becomes necessary to drain certain lands from the water with which they are saturated to too great an extent.

This then is a treatment entirely the reverse of that to which open porous soils should be subjected. These latter require that water should be led through them in a thousand minute meandering rills, which would spread over them the constituents of other and richer soils. To effect this, it is necessary (according to the ordinary practice of irrigation) to carry the water of existing streams on higher levels than those which they now pursue. But in order to drain the heavy clay lands, which contain too much moisture, it will on the other hand commonly be necessary to lower the levels of existing streams, in order that a sufficient slope may be obtained to drain into them the surplus water of all the surrounding lands. This operation is technically termed "bringing up the level" of a water-course, and may be thus described. A point is chosen in the course of the stream where the level is sufficiently below the district to be drained to answer effectually the desired end, and from this point the bed of the stream is deepened at an inclination a little greater than that which will serve for the flow of water. The deepening is continued upwards towards the source of the stream as far as may be required, and at the spot where it is discontinued, a sudden fall will be left in its bed, which may at any time be removed by carrying up the level for the drainage of lands above.

There are many operations connected with the water of an estate in addition to those we have described. Our remarks have principally been confined to those which are generally known under the names of drainage and irrigation; but besides these, there are manufacturing and commercial purposes of the greatest importance, to which water, as a moving power, can be applied.

There are few streams in the populous parts of this country that are not employed in the working of mills for grinding corn and other purposes, but at the same time there is scarcely one of such streams that could not be made capable, often at a trifling expense, of effecting double its present services.

To show the immense value of what brother Jonathan characteristically terms "water privilege," the river Wandle is probably one of the best instances which could be found. This insignificant stream, rising near Croydon in Surrey, and falling into the Thames at Putney, probably furnishes employment to more persons, and to more capital, than any river of its length in the world. In its short course of ten miles it turns not less than eighteen flour, snuff, and oil mills, besides supplying water to numerous calico, dyeing, bleaching, and printing grounds; also to copper works and iron works, forming with the mills about thirty-eight separate properties, deriving their principal value from the uses they are able to make of the water from this stream. It was computed by Mr. Malcolm, in his agricultural survey of Surrey, in 1805, that the Wandle furnishes employment for about 3000 people, when all the manufactories on its banks are in full work; and that the capital employed in these works fluctuates from a million to a million and a half sterling.

#### IMPORTANCE OF LEVELS IN CONNECTION WITH SURVEYS OF THE LAND.

In every kind of operation in which water is concerned, an acquaintance is required with the relative levels of many different points and parts of the surface. No improvement can be executed without such an acquaintance, no water can be conveyed in channels for irrigation, no drainage can be fully effected, no adaptation can be made of water to the working of mills, without at least some means of determining levels.

Now, there are a hundred ways in which a mere knowledge of the levels of many different points of an estate would suggest to the owner, and to others, ideas of improvement which it is impossible previously to imagine. The importance of models for agricultural purposes has of late been very clearly shown in several clever works by Mr. Bailey Denton; but we are of opinion that the whole advantages of modelling might be realized by the representation of levels, according to a clear and well-arranged system, upon the ordinary ground plan of a district. This idea of representing levels on a plane surface is suggested by that admirable method of tracing normal contours which has been practised on the recent ordnance survey in Ireland, and in the *cadastral*, or national survey of France. This method has been lately brought into public notice by the able description of Mr. Butler Williams in his work on practical geodesy. In its application to agricultural purposes, it might be effected nearly in accordance with the following brief outline. Let the lowest point on the estate be marked on the map as zero, or 0; then ascertain, by levelling, some other point on the surface which is just 5 feet above the level of zero, and proceed to determine a second, third, and fourth point, at convenient distances from each other, all of which are to be exactly 5 feet above zero. In this way determine as many points as may be necessary to trace on the plan a line, which in every part of it shall be of this same altitude, namely, 5 feet above the lowest point. This line will be termed the first horizontal contour. As many of these contours are to be traced, each 5 feet above the other, as may be necessary to reach the most elevated part of the estate. The heights of the highest points or summits may be figured, but this will be unimportant, because they cannot be more than 5 feet above the highest of the horizontal contours, and in many cases perhaps not more than 1 or 2 feet. Now, a plan on which these lines of levels have been laid down is, in our opinion, just as valuable as a model; from it the height of any point can at once be ascertained, within a very small trifle, indeed, with almost perfect accuracy, where it is most important to be accurate, as in beds of streams, and in like cases. A section may also be made from the plan, in any required direction, by taking off the distances between the contours, and setting off their elevations, an operation of great simplicity; and in fine, every object for which a model can be applied, may, with equal readiness, be effected by means of a plan containing a series of horizontal contours.

The plate exhibits the plan of a district containing about 840 acres, on which horizontal contours have been traced at a fixed height of 5 feet between each. The sections from A to B and from C to D show with what ease a profile in any required direction may be laid down upon paper, previously ruled with parallel lines 5 feet apart, which will represent the levels of the successive contours. To show the advantages of a plan on which horizontal lines of this kind have been traced, the following instances are given:

1st. Suppose it is required to know the extent of land which

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might be irrigated by diverting the course of the stream at *a* on plan: it is evident that the whole of the land lying between the contour No. 5, and the stream on both sides of the latter, is on a lower level than the point *a*, and therefore can be irrigated by a diversion of the stream from the point *a*.

2nd. Suppose it is required to determine the nearest part of the stream from which the water could be diverted to irrigate the point *b* on plan: this point lies between contours No. 5 and 6, so that if the water be taken from the point where No. 6 crosses the stream, it may be carried on a level sufficiently high to flow over the point *b*.

3rd. Required to know the fall which can be had from the point *c* on plan to the nearest part of the stream that is from *c* to *d*: the point *c* being on contour No. 9, those which occur between that point and *d* are five in number, so that the fall is 25 feet, plus the fall from where the 4th contour crosses the stream to the point *d*. This, by estimation, may be taken at 1 foot 8 inches, making the total fall, from *c* to *d*, 26 feet 8 inches. Hence, a level brought up from *d* will drain a pit 26 feet in depth at *c*. In order to drain a pit 40 feet deep at *c*, a level would have to be brought up from below the point *e*.

Many more examples might be adduced, but the above are sufficient to point out the advantages of this valuable addition to a mere measurement of the surface.

The expense of thus levelling and tracing the horizontal contours would be about 15s. per mile; and on the plan here shown about 31 miles in length are traced. This would amount to less than 7d. an acre, and probably it might be done for 6d., an insignificant sum when compared with the price of modelling, which could scarcely be less than 4s. an acre.

## TO THE EDITOR.

SIR,

If you will favour me by giving a place in your excellent journal to the following observations, I shall esteem it a kindness, and am not without hope that your so doing may be the means of conferring a benefit on the profession and public at large, by calling the attention of more able men than myself to the subject. In order that your readers may know what to expect, I begin by stating three articles of my architectural creed:—

1st. St. Paul's Cathedral is a finer building than York Minster, Salisbury Cathedral, or any English Gothic building whatsoever.

2nd. Whatever may be the beauties of Gothic architecture (and they are great and numerous), the style is not suited to most of our present exigencies, nor do I think it can be adapted to all of them.

3rd. Italian architecture appears to me to be the style best suited to the majority of our present wants, the most beautiful in itself, and the one admitting of the most ready adaptation to the various purposes required by us, whether of clubhouses, shops, &c., &c., excepting churches in general, where association gives so great charm and power to the Gothic style.

To enter into reasons for these opinions is not my present purpose, and, in fact, to do so would require a long essay, and I am well aware that very many members of the profession will deem

these opinions detestable, and others will condemn them as too absurd even to require controverting.—So be it. To those whose sentiments accord with my own on the subject, I would address a question: How is it that whilst Gothic architecture has been elucidated and popularized in numberless publications, not only by individuals, but by learned societies both at Oxford and Cambridge, the beautiful painter-like style of the Italian architects has had so little done for it in the way of illustration?

"The Glossary of Terms used in Architecture" has done more to popularize the study of Gothic architecture than any other work that has been hitherto published, whilst the Oxford Societies and the Cambridge Camden Societies are still adding fresh information to the fund already accumulated. These works are, I believe, intended for non-professional men (though on that point more anon), and they have been, and are, extensively sold and read; but they will give their readers a very one-sided or incomplete view of architecture, and the said readers, knowing nothing of any other styles, will gladly assume that there is nothing worth knowing in them: in fact, many architects have already stated as much.

Why does not some competent person, or some spirited publisher, bring out a work similar to the aforesaid Glossary of Architecture, but having its examples drawn principally from the classic styles, and above all from the *Italian*. Such examples, for instance, as many of the works of Peruzzi, Sansovino, and Sangallo, (*omit* Palladio), and such buildings as the Italian palazzi generally: in fact, we have now materials enough in this country for such a work, though they require collecting, arranging, and here and there polishing into shape.

There are many capital things in the Landscape Annuals: take some of these, have them redrawn by an architect who understands and admires the style, reduce to a smaller scale many of the plates of "Grand-jean et Farmin," "Architecture Toscane," Callet et Lesueur, "Architecture Italienne," and, if possible, give a place to Barry's exquisite "Traveller's Clubhouse."\*

Such a work as this would be very useful, I believe, even to architects; and here I would wish to make a few observations on what I conceive to be the prevalent defect in our present era of architecture—viz. our servile copying from our predecessors. I cannot but think that the exclusive study of such works as Stuart's Athens, Pugin's Specimens, &c., &c., some of the Italian works named above, has conduced greatly to this evil. Where a young student sees columns measured to decimal parts of inches; Gothic windows delineated with, if possible, greater nicety, and the parts of large palazzi figured to half inches, he is very apt to think them matters of vital, if not primary importance (I know I did so in the early part of my career), and he soon becomes a mere copyist. Now it appears to me that the object of publishing designs or plates of buildings executed, is, not to provide means of *copying*, but of imitating—of entering into the spirit and feeling which produced the original; and, without wishing or intending in any way to undervalue the works referred to, I think it is much to be regretted that architects have not had more books to study containing drawings of buildings as they appear in connexion with their scenery and locality. I am of opinion that the Greeks, the Romans, and the old Italian painter architects, designed their

\* I cannot but regret that there has been no *perspective view* of the Traveller's Clubhouse in the beautifully got up work published by Mr. Weale on that subject—a book which is not only a miracle of cheapness, but, with this one exception, in every way worthy Barry's *chef d'œuvre*.

buildings for a specific purpose and a fixed locality, and that in nine cases out of ten, their buildings, beautiful where they now stand, would be tame, inefficient, and comparatively worthless in other situations. This adaptation to surrounding or adjacent scenery or buildings is, in fact, an essential and *most important part of the design*; but unfortunately it is a part, which neither is nor can be shown in geometrical elevations, however well executed or minutely figured, or to whatever degree of accuracy the buildings are measured. I may be met with the remark, that most architects have travelled and seen the buildings for themselves; but if this is a solid argument, Why publish drawings at all? besides, I deny that *most* architects have been abroad, though unquestionably *many* have, all of whom I will venture to say would be very glad of reminiscences of what they have seen.

Every architect ought to be able to compose his own detail, and would, I have no doubt, be able to do so, did he really enter into the "feeling" of the style in which he is designing a work; and for my own part, I can assert that *good* (this of course is a *sine quâ non*) pictorial views of buildings have given me more of this "feeling"—a nearer approximation to one's sensations and perceptions when really viewing the structure itself, than ever I have derived from carefully drawn and figured "Elevations, Details, and parts at large."

A dictionary is a very useful and in fact an indispensable book; but a man who reads only a dictionary would have no very clear general view of a language, and certainly but a faint perception of its beauties. So, a man who studies capitals, shafts, bases, &c., and *these only*, will be but a poor architect.

I have seen architecture defined (with much more brevity than accuracy), as "The Art of Building"—it appears to me that "The Art of Copying" would be nearer the truth.

I am, Sir,  
Your most obedient servant,  
N. C.

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#### BOOKS OF REFERENCE FOR PROPOSED RAILWAYS, CANALS, ROADS, AND OTHER WORKS REQUIRING PARLIAMENTARY PLANS TO BE DEPOSITED.

The following instructions, prepared by an eminent Parliamentary agent, will be found useful by surveyors and others engaged in this business:—

1. Describe very accurately and minutely the nature of the property through which the line passes, such as orchard, garden, market-garden, paddock, park, yard, court, shrubbery, plantation of forest trees or otherwise, fold, yard, arable land, pasture land, spoil, waste, uncultivated or colliery ground, arable or pasture land in the whole or in part planted round with forest or other trees or shrubs, house, cottage, barn, stable, cowhouse, shed, or other erection, every thing by its proper name and appropriate description.

2. Ascertain the names of owners or reputed owners (whether freeholders or copyholders), the lessees (whether for life or years), and the terms for which they hold, where they can be ascertained, and the names of the actual occupiers or tenants; the latter, (that is, the occupier or tenant) are in all cases to be seen, and, in particular, inquiry made of them as to the owner or reputed owner to

whom they pay their rent, and all circumstances connected with the land, and in cases of doubt other parties are to be referred to. The names of the persons giving information to be set down in the columns left for that purpose, with the date when it was received.

3. In the cases of trustees of public bodies being owners, lessees, or occupiers, insert the local or customary style or name of the body, as "The Trustees of —— Charity;" "The Trustees of —— School;" "The Governors of ——;" "The Churchwardens and Overseers of the Poor of ——;" "The —— Canal Company;" "The Trustees of the Turnpike Road," or "The Turnpike Road leading from A. to B." adopting the customary or statute appellations. Observe the same rule with respect to highways, and describe them thus, "A public road or highway called —— Lane;" and insert the names of the surveyors of the roads as owners.

3. Ascertain in all such cases who is the solicitor, steward, clerk, or other agent, acting for the body. Insert occupation roads thus, as, "The Occupation Road to ——," in the column for description of property, and also the names of the owners of the lands adjoining the occupation road.

4. In the cases of private trusts, where the trustees are in possession and receipt of rents, insert their names, and the name of the party for whom they are trustees.

5. Where there are trustees, but the person entitled for life or otherwise is in possession of the receipt of the rents, insert the name of such person instead of the trustees.

6. Observe the same rule with respect to other representatives, as devisees in trust, executors, and administrators; but it should be remarked that executors cannot be inserted as owners of the fee, but merely representing lessees or personal interests.

7. Where a mortgagee is in possession and receipt of the rents, or a party is bankrupt, introduce the name of the mortgagee or assignees as the case may be, and also, in case of a mortgage, the name of the mortgagor or equitable owner.

8. When there are partnerships, insert the firm, and ascertain and set down who is the managing partner, or who is the clerk or other agent acting for the company.

9. Where there is a tenant for life and reversioner, insert the name of the tenant for life and that of the person immediately entitled in reversion.

10. In case of glebe land, insert in the column of owners the names of the incumbent, and the patron; and in the column of observations the diocese in which it lies.

11. Where the land is copyhold, describe it so in the column left for that purpose, and insert the name of the lord of the manor in the same column.

12. In case of commons, describe the common, and insert the name of the lord of the manor as owner.

13. In the case of open and common fields, insert the style of the body entitled as "The Parishioners of the Parish of ——," and the name of any party occupying any district or particular portion of the lands, and ascertain the name of the solicitor or other agent acting for the body.

14. Where there are joint tenants, or tenants in common, insert all their names.

15. In all cases ascertain and set down accurately the *christian and the surname of all persons noticed in any way in the book of reference*, their residence and address.

This is most material, and particular care must be taken to do

this as minutely as possible, in order to facilitate the future applications to them.

16. Ascertain and set down all the churches and chapels of ease in each parish.

17. Ascertain whether the lord of the manor has any exclusive rights in the rivers or brooks, and whether any other right exists in them than those of the proprietors of the lands or the adjoining banks, and state the name of the lord, and the extent of his right if he have any.

If the owners of the adjoining lands state that the lord has no right in the river or brook, and if such be the general reputation, record it. Number the rivers or brooks in continuation of the series of numbers, and put the owners and occupiers of the adjoining lands as the owners or occupiers of them if the tenant or occupier have the right of fishery, and right of the water.

If the river or brook divide a parish or township, it must be so described; as, the river \_\_\_\_\_, dividing the parishes of \_\_\_\_\_ and \_\_\_\_\_, or the township of \_\_\_\_\_ and \_\_\_\_\_.

18. Report to Mr. \_\_\_\_\_ immediately on any objection or difficulty occurring with respect to any owner or occupier on the line, accompanied with any remarks or suggestions that present themselves.

19. Be careful in ascertaining the exact boundaries of the different parishes, townships, or hamlets.

20. When the land is copyhold, describe it so in the column for that purpose, with the name of the lord of the manor.

size, and done in the same manner, but two openings are to be left in it for sluices, to be used for scouring away the mud, in case a basin or reservoir shall be made within to hold water for that purpose.

Those walls are to be faced with ashlar in courses of not less than 12 inches thick, header and stretcher: the headers not to be less than 2 feet wide in the face, by 3 feet deep in the bed, nor to be placed further asunder than 6 feet; none of the stretchers are to be less in length than 2 feet, nor less in depth on the average than 2 feet, but none less than one foot nine inches, and each course is to be continued of the same thickness the whole length of the wall. The stones are to be left rough in the face, but all the joints, beds, tops, and ends, are to be dressed round with a chisel, and fair punched between.

The backing and counterforts are all to be square, hammer-dressed, and laid header and stretcher similar to the face, and so that the header be opposite the stretcher, and they are to be of a size suitable to the radius of the front courses.

The coping is to be of stones not less than 15 inches thick by 3 feet broad, and none are to be shorter than 3 feet, but as much longer as the quarries will produce.

All their beds and joints are to be dressed and arised, or rounded off on the top next the sea; they are to be kept together by stone dowels placed in the joints.

The whole of the work is to be done with good mortar, prepared in the following manner, namely: The lime is all to be burnt in the best manner, and ground into a powder as soon after burnt as possible, without being slackened. One bushel of this powder is to be mixed with three bushels of clear sand, and used for 3 feet deep in the wall. Mortar made in this manner for the front of the work, and thoroughly beat and mixed together, will harden in water, provided the joints are plastered over with Parker & Co.'s Roman Cement; but it might, perhaps, be as cheap, and answer the purpose equally well, if, instead of this mixture, a mortar was to be made in the proportion of one bushel of lime powder to one bushel of burnt ironstone, and two bushels of sand. The backing mortar is to be one part of dry lime powder to four parts of sand.

The whole work is to be laid flush in the above mortar, and well grouted and filled with stone spauls where the inside joints will admit.

The space between the outer and inner walls of the pier head is to be filled with rubble stone, and gravel or pan ashes so mixed as to make it solid, and the top is to be paved with good hard stone similar to those at the north Queen's ferry.

The whole of the work is to be done to the satisfaction of an inspector to be appointed by the Right Honourable Lord Keith, and in case the contractor should fail in any respect in the due performance of the work, or does not do it to the satisfaction of the inspector, his Lordship shall have it in his power to set aside the contract, and take the work out of the contractor's hands.

In case the agitation of the sea should cause the vessels to work on the walls, so as to be injurious to their face or to themselves, it will be proper to fix wooden fenders upon them, at the distance of ten feet from each other.

(Signed) JOHN RENNIE.

#### SPECIFICATION BY THE LATE JOHN RENNIE, ESQ. OF A PIER AND BREAST WALL, PROPOSED TO BE BUILT AT KINCARDINE, ON THE ESTATE OF THE RIGHT HONOURABLE LORD KEITH.

THE foundations are to be sunk through the mud to the solid rock, and the rock is to be cut into a form suitable to the foundation of the pier walls, which are to be set firmly upon it. The outer or south wall of the pier is to be 470 feet in length, as represented in the drawing; it is to be 7 feet thick in the base, at the extremity, and 4 feet at the top, and in the line of the breast wall it is to be 6 feet thick at the base, and 4 feet at the top, diminishing gradually in thickness until it reaches the shore, where it should be of the same thickness as the said outer wall at the same height above its base.

The head is to be of the same size, but to have two counter-forts in it.

The wall is to be curved in the perpendicular to a radius of 90 feet, the centre of which curve is to be on a level with the top of the quay wall, and to this centre the joints of all the stones are to lie. There are to be twelve counterforts behind the wall, 4 feet square each, at the distance of about 21 feet from each other: these are to terminate opposite the breast wall, after which there need be no counterforts.

The inner or north wall of the pier is to be 6 feet thick at the base, and 3 feet at the top, and is in the like manner to be curved in the perpendicular as the south wall, with the joints of its stones running to the centre of the curve, and there are also to be twelve counterforts to this wall. The breast wall is to be of the same

## THE DRY ROT IN TIMBER.

TO THE EDITOR.

SIR,

AT a recent meeting of the Institution of Civil Engineers a paper was read, and discussions arose, in relation to the subject of kyanising wood. It is well known that the destruction of timber called dry rot results from the fructification of several varieties of fungi; the conditions necessary to their development appear to be the existence of sap in the timber, and this in a subacid state. At whatever time trees may be cut down they are never free from sap, nor can the whole of the sap ever be removed by drying or seasoning. Dutrochet observed, that distilled water holding albumen in solution will not generate fungi in twelve months, but on the addition of a small quantity of acid they were generated abundantly in a few days. He also found that the oxides and salts of mercury would prevent this generation. The bichloride (or corrosive sublimate) has generally, I believe, been used for the purpose of preventing the growth of fungi in timber; this I think quite wrong. Water at the temperature of 60° dissolves more than one-twentieth of its weight of the bichloride of mercury, and this must consequently soon remove, for some depth at least, the corrosives sublimate with which kyanised timber is saturated. It is, therefore, not surprising that this substance has not been found to answer the purpose. Under all circumstances I am of opinion that the protocloride (or calomel), which is quite insoluble, would be found a more effectual protection. And, in the consideration of this subject, another question presents itself: Might not the durability of timber, generally, be increased? Nature has been said to be the mother of art. In the great accumulations of vegetable matter and tannin, which constitute morasses or bogs, the most minute fibres and the largest trunks of trees have been preserved for ages, and in some instances the clean cut surface from the axe is quite distinct and sound. It is well known that this preservation results from the presence of tannin, which is the astringent principle, derived from the bark of oak and some other trees. It is probable that the districts containing extensive and numerous bogs in the moist climate of Ireland would not be habitable, were it not for the presence of this astringent principle. It is probable, also, that the lighter kinds of wood, saturated with this principle, would be rendered much more durable. Its effects on animal tissues are well known: it is soluble in water, and they are also, but when united they form the insoluble impure compound called leather. The process might be the same as that for kyanization. It is true that tannin would have no tendency to prevent dry rot, for it is abundantly present in the wood of oak; but there is every reason to suppose that it would greatly contribute to effect the durability of timber. It is soluble in water, but probably some of the substances used as mordants in dyeing would render it insoluble for wet situations.

I am, Sir, yours,  
W. G.

London, June 8.

## SPECIFICATION OF LOCOMOTIVE ENGINES ON THE LONDON AND BIRMINGHAM RAILWAY.

**CYLINDERS.**—Two horizontal cylinders, 13 inches diameter, fitted with single slide valves, and metallic spring pistons. Length of stroke, 16 inches.

**BOILER AND FIRE-BOX.**—Cylindrical portion of the boiler, 8 feet long, and 3½ feet diameter.

Malleable iron plates,  $\frac{1}{8}$  inch thick.

Copper fire-box, 2 feet 6 inches long, by 3 feet 4 inches wide, inside.

Depth from the crown to the upper side of the fire-bars, 3 feet 3 inches.

A clear water space of 3 inches to be left on all sides of the fire-box, except that next to the cylindrical part of the boiler, which must be 4 inches.

Extreme width of fire-box casing, not to exceed 3 feet 11½ inches.

The plates, forming the roof and sides of the fire-box, to be  $\frac{1}{8}$  inch thick, excepting the tube plate, which must be  $\frac{1}{4}$  inch thick.

The roof plates to be strengthened by four wrought-iron bars riveted to the upper side. The sides to be supported by copper stay bolts tapped and riveted.

The hole for the fire door to be of an oval shape, and formed by setting the plates together, so as to approach within 2½ inches of each other. A copper ring of that thickness is then to be inserted with  $\frac{1}{8}$  inch holes drilled in it 2 inches asunder, and then closed by sound copper rivets.

**TUBES.**—115 tubes 1½ inches diameter outside, not less than 1 inch asunder, made of the best tough rolled brass, with a lap joint; the edges of the sheet being first properly chamfered, and the solder applied inside. The thickness of the brass tube, No. 15 wire gauge, to be made truly cylindrical by drawing through a die.

The holes in the back plate of the fire-box for receiving the tubes to be drilled truly cylindrical, without counter-sink, and the tubes inserted in the usual manner by steel hoops.

**WHEELS.**—The engine to be placed on six wheels; two pair 3 feet 6 inches diameter; the principal or driving pair, 5 feet diameter. The nave of these wheels to be of cast-iron; the arms and rim of malleable iron, and hooped with a tire 1½ inch thick, and 5 inches wide, inclusive of flange. The flange to rise 1 inch above the coned portion of the tire. The combined form of flange and cone of the tire will be accurately described by a template, furnished by the company. The large wheels may be made with or without flanges.

**AXLES.**—Cranked axle to be made of the best backbarrow iron; 5½ inches diameter at the crank pins; 4½ inches diameter in the middle between the cranks; 5 inches diameter alongside the nave at the inner bearing; 4½ inches diameter inside the two cranks; 3½ inches diameter outside bearings.

The whole of the angles well rounded off, according to a pattern to be furnished by the company.

The axles of each pair of small wheels to be 3½ inches diameter, with 3-inch bearings.

All bearings of axles, and eyes of working gear, to be case-hardened.

**FRAMING.**—The cranked axle to be supported by four inside longitudinal wrought-iron frames, with brass bearings inserted. These frames will be attached to the casing of the fire-box at one end, and to the smoke-box at the other, for the purpose of firmly staying the cylinder beds.

The outside, or principal framing, to be made of well-seasoned ash plank, 3 inches thick and 7 inches deep, plated on both sides with sound low-moor plates (or others equal in quality)  $\frac{1}{2}$  of an inch

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thick. The underside of this frame to be 3 feet from the surface of the rail.

**FEED PUMPS.**—One to be worked by each cylinder. The working barrels and valve seats to be of the best tough brass, with a clear circular water-way throughout, not less than 2 inches diameter. The suction-pipe to be constructed with double ball and socket piece, to avoid the necessity of leather or India rubber pipe, for communicating with the water tank.

**EXCENTRICS**—May be made to shift on the cranked axle, in the manner hitherto generally adopted; or fixed on the axle, provided the method of "changing the gear," and the other conditions requisite for placing the slide-valve correctly when the engine travels backwards or forwards, are approved by the company's engineer.

For details of arrangement, description of workmanship, and general fittings, such as working gear, safety valves, gauge cocks, water gauges, buffers, splashes, safety guards, wire chimney cap, wood sheathing to boiler, and other similar appendages for putting the engine in complete working order, the Fire-fly engine, now working on the Liverpool railway, is referred to.

Any deviation not affecting the above general specification may be made, provided it is previously approved by the company's engineer.

**TENDER.**—To be similar in form and construction to those generally employed on the Liverpool and Manchester Railway. The framing to be of ash; the tank of wrought-iron plate,  $\frac{1}{2}$  inch thick, to be capable of containing 700 gallons of water, and furnished with the necessary means for communicating with the ball and socket suction-pipes before described.

The wheels and axles to be precisely similar to the small wheels described for the engine.

The tender to be supported on springs, and furnished with a long transverse spring at each end, for drawing by, together with a brake and buffers. Also a box of tools, containing a complete set of spanners, suited to the different-sized screw-bolts and nuts throughout the engine, with cold chisels, hammers, and duplicates of such bolts and nuts as require to be moved in the general course of working.

The engines and tenders to be subject to the inspection of the company's engineer, and a trial of not less than one week on the company's road. And if the company should deem it necessary to test the boiler, they shall be at liberty to do so with water pressure not exceeding 120 lb. per square inch.

**N.B.** The Directors will receive tenders for the supply of locomotive engines, which may not be conformable to the foregoing specification, provided the construction of such engines shall be considered by the Directors better adapted for the intended work.

#### THE TIMBER TRADE, AND ITS CONNECTION WITH BUILDING.

THE proposed reduction of duty on foreign timber will, it is thought, give a considerable stimulus to building speculations; and several petitions have been presented to Parliament from Hull, from Wexford, and other places, praying that the proposed reduction may come into operation immediately, or not later than July, the

time at present proposed by the Government being October next. On the other hand, several petitions from Miramichi and St. John's, in the province of New Brunswick, loudly complain of the effect which will be produced in the colonial timber trade, by the proposed reduction of the duty on foreign timber. The ship-owners of South Shields contend, that the alteration in the duty will have the effect of excluding to a certain extent the imports from North America, and of increasing in a corresponding degree the demand for timber from the ports of the Baltic.

The American timber is wholly imported in British vessels, and the Baltic chiefly in foreign, and hence the objections of the ship-owners. A few petitions from the owners of woodland complain that the price of home-grown timber, and particularly of beech, will be greatly reduced by admitting foreign timber at a lower than its present duty, and that this would throw out of employment many persons employed in the winter in cutting down and converting beech timber.

In addition to these petitions, there is a memoir before us on the subject of the colonial timber trade, by the Committee of the North American Colonial Association, in which the claims of Canada, Nova Scotia, and New Brunswick, to protection in respect of their trade in timber, are very forcibly and ingeniously urged upon the attention of the government. The Committee contends that the reduction of 5s. 4d. a load, which it is proposed to make on the importation of timber, will, in reality, prove to be a reduction of duty to a much greater amount than this upon deals and upon timber in logs, which two forms constitute by far the most important part of the whole trade in timber. They aver, for instance, that the proposed alteration will so operate as to reduce the duty on timber to the extent of 19s. 10d. per load, and that upon deals to the extent of £1 13s. 6d. a load upon those of 12 ft.  $\times$  9 in., but the reduction of duty upon deals will vary according to their dimensions. These extraordinary results, say the Committee, are attributable to the way in which the present duty payable on foreign timber has been estimated as the basis of the ministerial measure, and to the reduction of 5s. 4d. per load on the average of the whole amount of duties paid, instead of separately reducing the amount of duty payable for each kind and form of wood imported to the extent of 5s. 4d. per load. The Committee states, that the average has been taken upon timber, deals, staves, lath-wood, fire-wood, spars, and some minor articles, as knees and handspikes. "Yet the reduction upon that average is applied to timber, deals, and staves only, to the exclusion of lathwood, and firewood, spars, knees, and handspikes, for each of which specific duties are distinctly and separately made." The conclusion to which their inquiries have led the Committee is, that the present duty upon foreign timber being £2 16s. 6d. a load, yet an average reduction of apparently but 5s. 4d. a load in protection, will have the effect of reducing that duty to £1 6s. 3d. We cannot pretend to examine, and still less to decide upon, the varied and complicated considerations from which this result is derived; but it certainly does seem, if correct, to take from our colonies of North America a much greater extent of protection than has ever before been contemplated by any ministry. It seems that Lord Althorp's measure, which he unsuccessfully attempted to carry in 1831, proposed only a diminution of protection to the extent of 15s. a load, by means of a reduction of that amount in the duty payable by foreign timber. Without, however, entering at all on the province of determining what would be the most judicious amount of protection to confer

upon our colonial timber trade, it would seem that some reduction of the present duty on foreign timber would operate most beneficially to our home artisans employed in the various operations of house-building. Timber forms so important a part of the expense in a house, that a reduction in the price of this article will materially promote building speculations. The Committee, to whose memoir we have referred, states that the benefit from the proposed reduction has been computed to amount to less than one and a half per cent. of the whole cost of building a house; but if the effect of the reduction be really so trifling as this, it goes against their own argument, and seems directly to contradict the statement that the reduction of duty on foreign timber will be anything like 30s. a load, which the first part of their memoir is intended to prove.

The enormous trade in timber carried on between this country and her North American colonies appears to operate against that rapid progress in agriculture which might have been expected. The colonists complain that the length and severity of the winters, and the shortness of seed-time and harvest, unfit the timber-growing provinces, in a great measure, for the successful cultivation of the land, at the same time pointing with great triumph to the rapid growth of their cities, and to the rapid increase of population, which they justly attribute to the trade they have been able to carry on in timber.

The parliamentary return for the year ending 5th January, 1842, states the quantity of timber, 8 inches square and upwards, imported into the United Kingdom from British America to be 639,066 loads, and the quantity from all other countries 124,645 loads. The return is imperfect as to the importation of battens, deals, and staves, as no distinction is made between the quantities of the latter imported from British America and the quantities from foreign countries. It seems that, notwithstanding the gradually increasing imports of timber and deals from our colonies ever since 1793, the province of New Brunswick, containing 17,000,000 of acres, has only been cleared from the native forest to the extent of about 500,000 acres, or  $\frac{1}{34}$  part of its whole area. The entire energies of the inhabitants appear to be devoted to the timber trade; and the province contains no less than 574 mills for the manufacture of deals, the value of which mills is estimated at £500,000.

#### THE NEW SCALING INSTRUMENTS.

SIR,

I REGRET that my absence from London in a distant part of the country prevented me from observing, till within the last few days, an article on the new scaling instruments, which appears in your Journal of October last. I trust, however, I am not too late to request your attention to the manner in which my name, as the inventor of the scaling instrument, has been mixed up with that of Messrs. Troughton and Simms, who are merely makers, not inventors of an instrument for measuring maps, on the same principle as mine.

It is true that the article which I refer to states that I am the inventor of the instrument which bears my name, but what I have to complain of, is this: that the two instruments are arrayed against each other in such a manner, as to lead people to the supposition that they are the fruit of two separate inventions. This I would submit is the conclusion which would be arrived at by the

readers of the article in question: they would naturally think that two kinds of instruments were invented contemporaneously, one by me, and one by some other person. Now, Sir, with your permission, I will state the facts of the case: I invented the present system of computing maps (and of course the computing instrument at the same time), in May, 1839: in July, 1839, I sent a description of it to the Tithe Commissioners, and also made it known at the same time to several surveyors. In August, 1839, I was employed by the Tithe Commissioners to compute maps, and I beg to affirm most decidedly that the instrument made by Messrs. Troughton and Simms was not known to the Tithe Commissioners at that time, nor for some weeks afterwards; and it therefore clearly follows, that my instrument introduced the original principle of the invention, and I claim the credit of inventing the method and the principle of computing maps, which has been found so valuable by surveyors, and not the mere instrument, which is capable of modification in many different ways.

I am, Sir,  
Your most obedient servant,  
ROBERT MASON.

12, Buckingham St., Adelphi.

[We have great pleasure in giving insertion to this statement by Mr. Mason; but he will observe, that in the article which he refers to, there is nothing which contradicts his claim to be considered the inventor of the principle of scaling maps by means of a frame of moveable parallel lines.

The invention of the principle was left an open question, as the only object sought in that article was to introduce to the notice of surveyors two forms of instruments, either of which they might employ with great advantage in the scaling of maps.—ED.]

#### CHURCH ARCHITECTURE IN ENGLAND.

[THE following questions are sent to us by a correspondent who has devoted much attention to the ornamental architecture and decoration of churches. They apply principally to defects which our correspondent complains of in the modern churches of this country.]

1. If the roofs were much higher, would not the ventilation be much freer, and the building more ornamental, as well as easier to speak in?
2. Might not very small dormer windows be placed in the roof, as in so many foreign churches, where they are made ornamental, and, at the same time, useful for ventilation.
3. Are not triangles too little made use of, especially in doorways?
4. Should not the depth of the reveals of the windows be increased?
5. Should not the length of the windows be greatly increased, perhaps to  $\frac{1}{3}$  of the whole height of the church, or nearly so? If this were the case, and the form were good, would it not supersede the necessity of an attempt (generally unsuccessful) to produce flowing tracery; a simple heading would alone be required.
6. If a gallery must be made, might it not take the appearance of a triforium, with open work in front, and *not standing as far forward as most galleries do*? Or, if the part of the wall below

the gallery were wider than that above, and there were a groined roof for the gallery, coming half over it, above might be clerestory windows, which would add more to the lightness of the church than the gallery would take away.

7. Would it not add to the size, and extremely to the beauty of every church, to have an absis,—circular, three, five, or many-sided, at the top, the groins merely overhanging the windows, and forming them into niches, with long windows between each? This is all the ornament that would be required for the altar, and it might be endlessly varied.

8. Would not groining, however simple, add much to the beauty and apparent strength of the building?

Nothing can be more simple and beautiful than the quadrangular groining so often seen in the Belgic churches.

9. Should not buttresses be much more used? Nothing can give so great an appearance of stability, or be made more to add to the grandeur of a building, so as to supersede all more trifling ornaments.

10. Might not the lozenge form of the steeple be introduced with advantage, and give the height and finish to a tower, which is now so often lacking?

11. Should not the choice between the adoption of a tower or a spire be regulated by the situation of the church? If it will be seen from a great distance, or should it stand among trees, or in a low place, then a spire?

If in a very open place, a tower?

If to form a front be required, e. g. in a street, then perhaps two low towers (but then the *west* end must face the street), or the same crowned by a lozenge steeple? If in a street where much does not depend on the *fauade*, or in a village, then either a very slight low tower, crowned by a very slender spire, or simply a bell tower?

12. Should not benches be always used, instead of pews?

#### SHENLEY CHAPEL OF EASE.

(*With a Plate.*)

In presenting to our readers the plan and elevations of a recently erected Chapel of Ease, at Shenley St. Botolph, Herts, we have much pleasure in noticing that this structure owes its origin to the worthy rector, the Rev. Thos. Newcome, who, taking into consideration the distance between the old church and the village, which, in rainy and inclement weather, wholly prevented the elder and more infirm portion of his parishioners from attending divine service, caused its erection, at his own private cost, near the centre of the village: a motive in itself so laudable that we trust it may act as an example worthy of being followed by many other clergymen and wealthy landed proprietors.

The chapel contains accommodation for two hundred persons, and is a plain neat Gothic edifice, suitable to the usual character of the surrounding district: it is substantially built with red bricks, and has Bath stone copings, cornices, and mouldings. The bell turret, with the spire and vane on its summit, which is placed on the south-west angle, rises to the height of above fifty feet, and has a pleasing effect when viewed rising above the trees.

The interior, forty-eight feet in length by twenty-four feet in breadth, is fitted up entirely with free seats instead of pews, the ends of which are in Gothic moulded panels, terminating with finials; there is only a reading desk for the clergyman and a pedestal for the clerk, which are placed on the south side. The altar is very imposing, the decalogue, &c., being written in old English characters, highly illuminated on a dark crimson ground, within Gothic panels. We think the effect, however, would have been greatly improved if another step had been added to the approach to the altar.

There is an open frame queen-post roof, with pendants and trefoil spandrels springing from moulded oak corbels, each truss being filled in with open Gothic panel tracery; a pendentive ornamental Gothic moulding, running under the ridge-roll the entire length of the interior, has a novel and pleasing appearance.

The whole of the boarding, rafters, trusses of the roof, free seats, &c., are painted in imitation of dark oak, and the walls are stuccoed, floated, and jointed. The front of the structure is enclosed by an ornamental open panel dwarf brick wall, with suitable entrance gates, surmounted with an indented brick moulding and coping.

In erecting this chapel no expense was spared: it was executed at measure and value prices, and, including the inclosures, the cost, which we have already said was borne by the munificent rector, exceeded the sum of fifteen hundred pounds. The architect, Mr. S. Staples, has gained considerable credit by the manner in which he has executed his task.

#### REVIEW OF BOOKS.

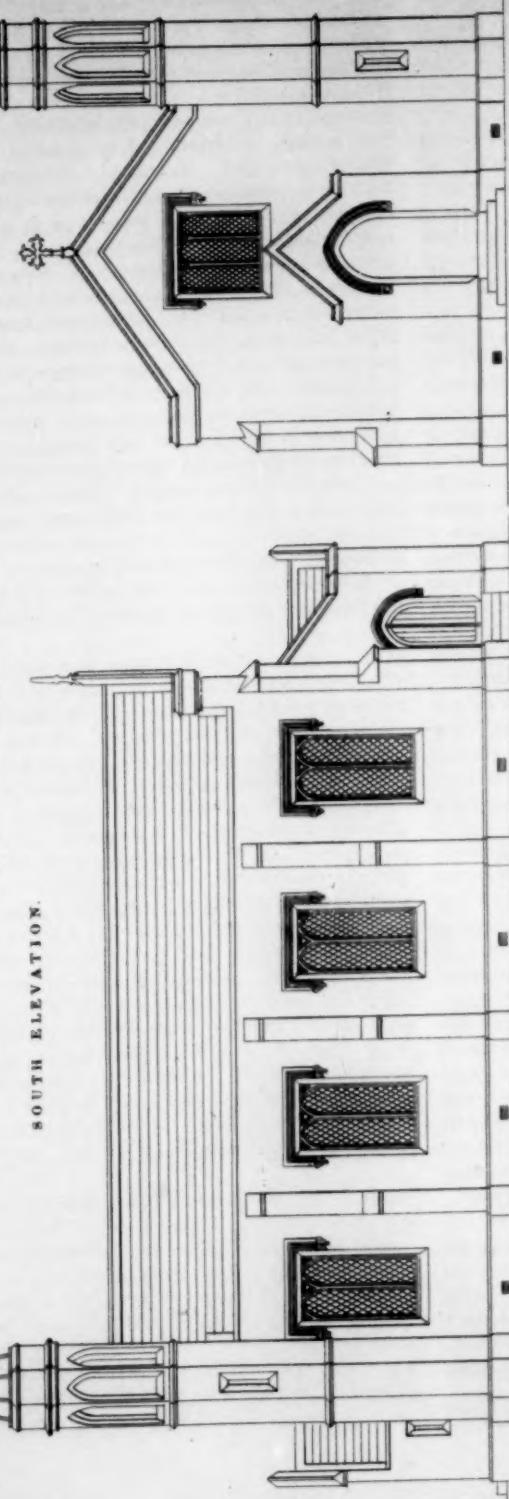
*Iron as a Material for Ship-building: being a communication to the Polytechnic Society of Liverpool.* By John Grantham, C. E., President. London: Simpkin, Marshall, and Co.; and J. Weale.

AMONGST the most striking effects of that skill and energy with which civilized man is gifted, may be ranked that bold and successful application of minerals which he has wrested from the bosom of the earth, to every varied and complicated use for which the more simple productions of the vegetable kingdom were originally placed within his reach by the beneficence of Providence, in compassion to the infant state of his intellectual powers. In place of the wooden huts and hovels of our ancestors, the enduring edifice of brick or stone presents a material, in either case, of mineral origin. In place of the wooden spoons, the platters, and the bowls, of our forefathers, we have these utensils fabricated from clay, dug out of the earth, and from ores of iron, and tin, and copper. The great antagonist of wood, however, is iron—that invaluable production of the mineral kingdom, by which it has been more extensively superseded than by all others put together. It is remarkable that, in most countries where the iron manufacture is now extensively carried on, the earliest smelting works exclusively employed wood in the process of making iron. Such was the case, particularly, in this country, where, at Furness, in Lancashire, and about Cuckfield and Crawley, in Sussex, wood was the only fuel employed in the iron works for many centuries. Thus it was with wood and iron as it sometimes is in human affairs—the former was first instrumental in giving a value to that which was destined afterwards to supersede

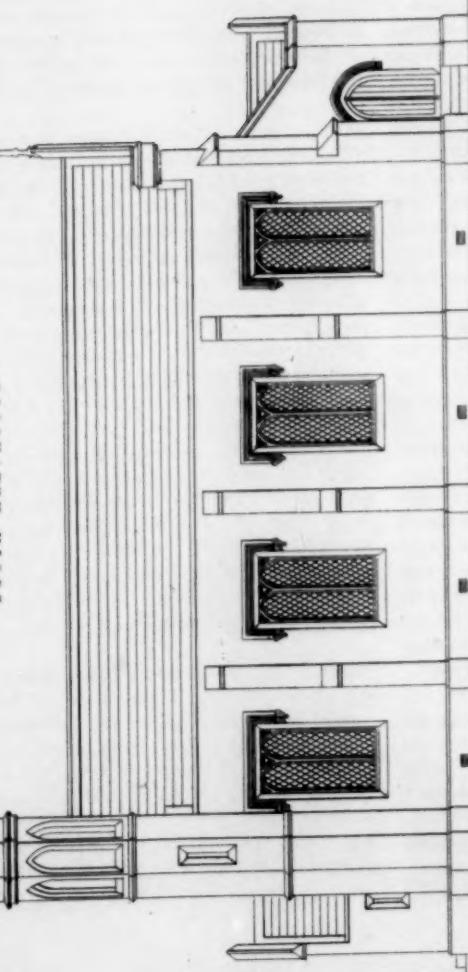
CHAPEL OF EASE SHENLEY. HERTS.

S. STAPLES, ARCHT'

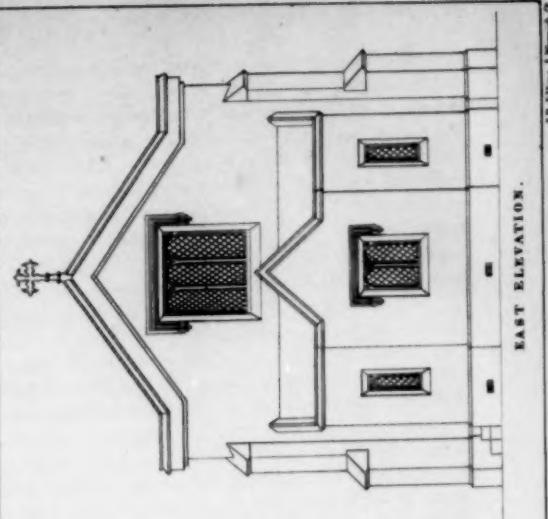
WEST ELEVATION.



SOUTH ELEVATION.

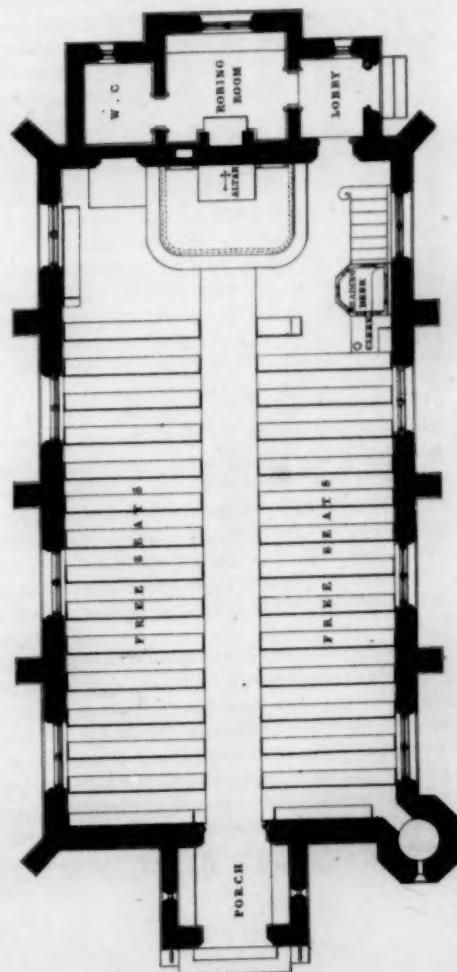


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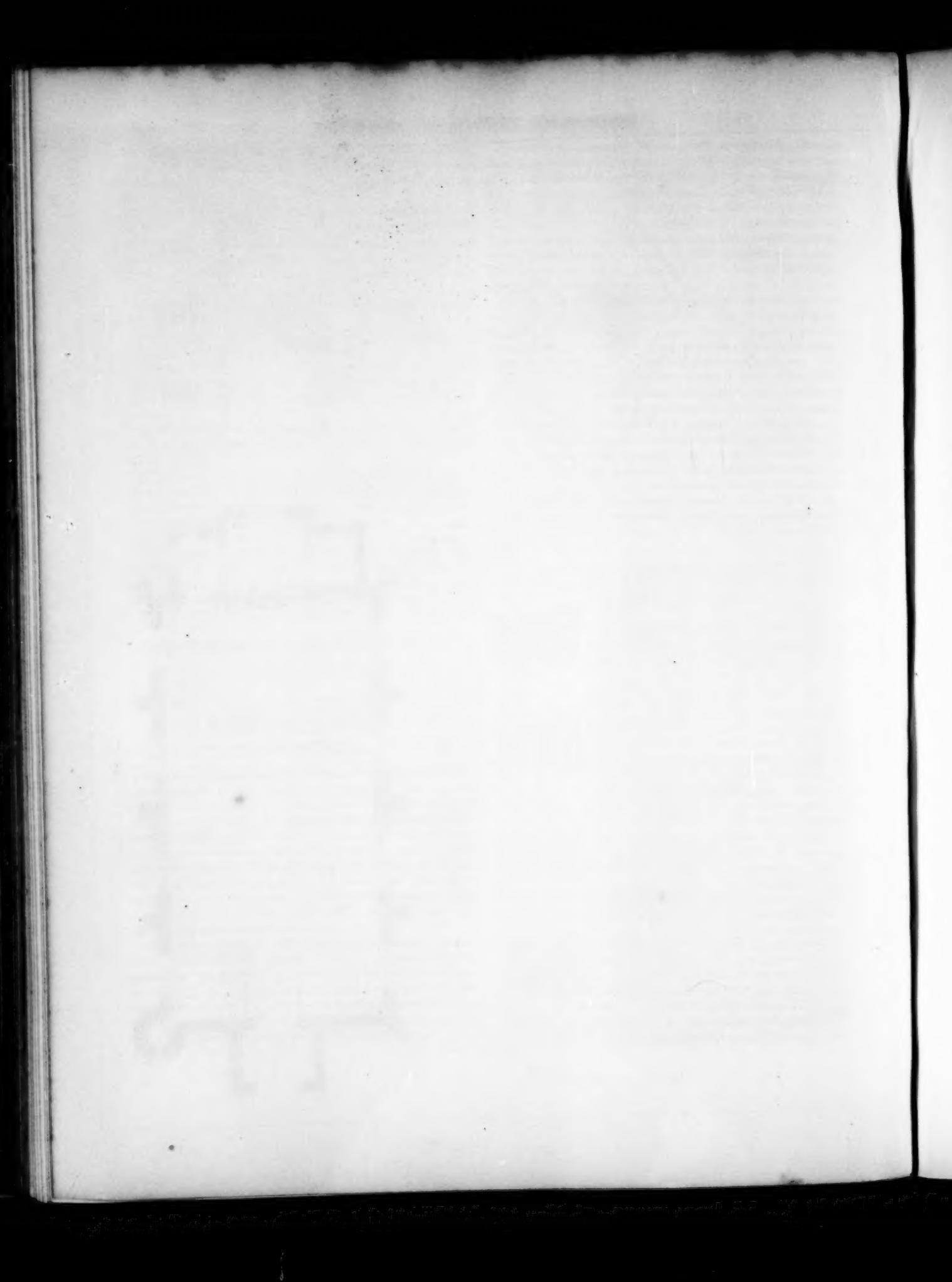


EAST ELEVATION.

J. E. Johnson & Son, Ltd.



GROUND PLAN.



it in every possible way, and to usurp its place with the most merciless rapacity. We need not observe how extensively coal has superseded wood, not only for manufacturing purposes, but as the fuel of almost every domestic hearth throughout the kingdom.

It would seem—when we consider the gradual disappearance of the forest from the surface of civilized countries, and the constant tendency which the ingenuity of man exhibits to construct every implement and machine out of materials which he has himself brought to light from their deep caves, in the bosom of the solid earth—it would seem to be a law of nature, of which successive steps in civilization afford a successive development, that the producing power of the earth, as exhibited in the growth of vegetable life, shall at last be confined to the production of grain, and plants, suitable for the support of animal life. The increased capacity for supporting population, exhibited by every new census taken in this country, is no doubt greatly owing, amongst other causes, to that extensive substitution of minerals for timber, which we have spoken of: gradually for several centuries the amount of woodland in this country has been decreasing, until it has ceased, at the present time, to supply sufficient timber for the demands of our extensive navy, and for house building. Notwithstanding, however, the vast supply of timber derived from our colonies, and from other countries, for the purposes of ship-building, there can be no doubt that the general introduction of iron vessels will throw into cultivation, for the purpose of raising food, a vast amount of woodland which is now occupied in Great Britain by the growth of oak timber.

It may here be asked, as a question of great importance, Will this event prove to be of national advantage, or the contrary? We are decidedly impressed with the conviction that it will be of the former character, and that, too, at a less sacrifice of particular interests than that which generally attends any great national improvement. The majority of the great woods in this country, as the New Forest in Hampshire, Hainault Forest, Sherwood Forest, the Forest of Dean, and others, which principally supply timber for the navy, are chiefly the property, either of the crown or of great landowners, who would suffer little inconvenience from the necessity for gradually stocking up the trees, and throwing the ground they occupy into more profitable cultivation. It may be urged that our colonies would suffer materially from the loss of a market for the vast quantity of timber which they produce. The injury here inflicted, however, would be of a very temporary nature, and would, probably, in the course of a few years turn out to be any thing rather than an injury to our colonial interests. It should be remembered that the present high price and extensive employment of colonial timber serve as a premium to the land-owners in the colonies to keep their lands out of cultivation, by which means they are losing ground, instead of rapidly advancing in improvement and civilization.

The expediency of employing iron for the building of all classes of ships comes now to be considered as a national question, and, intimately interwoven as it is with the successful prosecution of steam navigation, there is, probably, no question of modern times, which, under every aspect, is so generally important. The confessed superiority of the steam vessels which are now so commonly employed in navigating the Atlantic Ocean and the Mediterranean, has afforded the best practical refutation to the doubts and fears of certain minute but well-known philosophers, who endeavoured by every means in their power to embarrass the operations of the

Steam Navigation Companies in the very outset of their beneficial and most laudable undertakings.

The great problem of steam navigation to India is now the one whose practicability remains to be solved, and, however widely opinions may differ on the subject of this practicability, it appears certain, that if ever steam navigation between Great Britain and India shall be successfully carried on, it will be by steam ships constructed of iron. The capacity for stowage in the largest iron ships as compared with those of wood, is stated by Mr. Grantham to be as 6 to 5, so that an iron ship of 600 tons will not exceed in outward dimensions the timber ship of 500.\* This gives an immense advantage to the iron ship, where the coals necessary for the consumption of a long voyage occupy so large a portion of her gross cargo.

It is a subject of great regret that the government of this country, acting in a spirit of extreme opposition to the policy of most continental states, has thrown too great a weight and responsibility upon individual exertions in relation to the advancement of steam navigation, and the introduction of iron ships. Mr. Grantham, in the communication before us, laments in terms which reflect great honour upon himself the ruinous loss of fortune which has attended the spirited exertions of individuals in the prosecution of steam enterprise. The following remarks are well worthy of attention, because, although some of the evils consequent on the apathy of government have already been inflicted, and can scarcely now be remedied, it remains to be seen whether the adoption of iron vessels for the royal navy will meet with more of that favourable consideration which has been so tardily conceded to the introduction of steam vessels of war.

"It is well known that in this department"—the steam department of the navy—"the operations of the government for several years lagged far behind those that have resulted from private enterprise. Until within a recent period, they seemed to have viewed steam as an innovation, of questionable utility, upon old-established practice and national feeling, as many yet regard the introduction of iron in ship-building; and they appeared to pause, with an almost unaccountable apathy, till the great national experiment had been tried at the cost of individuals. I need not ask whether such a course was to have been expected from the government of a country where all is dependent on her ships. They would surely have done well, had they called together all the united talent of the nation, and stimulated the energies of her engineers. To the want of such steps may, in a great measure, be attributed the circumstance that steam property has been the ruin of thousands. Owners of steam vessels, narrowed in their resources, were obliged to trust for improvements to the random experiments of unscientific men, who have had no standard to guide them; and the burden, which would scarcely have been felt, had the well-combined exertions of a government been directed to the subject, has been allowed to fall upon her people."

It were well if these remarks, as true and just as they are sensible and moderate, should have the effect of turning the attention of the legislature to the immense superiority of iron ships before it is too late to reap the full advantages of their introduction into our navy. It is no argument to say, that the almost exclusive capacity which this country possesses for manufacturing iron on an extensive scale will prevent competing nations from availing themselves of a steam navy of iron ships, until after it shall have been adopted by

\* Thus, an iron steam ship of 600 tons will contain an equal net cargo with a timber ship of the same outward dimensions, and at the same time 100 tons of coal in addition.

our own government. It was notoriously not thus with steam navigation, notwithstanding the great superiority of our engines over those made in all other parts of the world; and, besides this, the continental states are already employing iron ships, and it is long since the Aaron Manby,\* one of the first of its kind, was built for the navigation of the Seine.

The following consideration will afford some idea of the immense importance of steam navigation in a national point of view. Supposing the whole value of the exports and imports of the United Kingdom to amount in round numbers to £120,000,000 annually, which will not be far from the truth, and estimating, merely for the sake of comparison with the same commerce carried on in steam vessels, that the average duration of voyages is about two months, it will follow that one-sixth of the preceding amount, namely, £20,000,000 of property, must be constantly afloat all over the world to and from Great Britain alone. Now, it may be fairly assumed that steam voyages generally will be performed in one third of the time occupied by sailing ships on the same voyages; and it follows from this that £120,000,000 of property annually exported by means of steam navigation, will require only one-third of £20,000,000, or less than £7,000,000 sterling to be constantly afloat. Thus, the remaining £13,000,000 of capital, now employed in the commerce of Great Britain with her colonies and with foreign countries, will be at once available on the general introduction of steam navigation, to be diverted into a thousand other channels for the development of human resources, and the promotion of human welfare.

It is impossible to foresee the full extent of national benefit which such a result as this will produce. Surely, when considerations of such vast importance are involved, the whole subject of steam navigation, and in connexion with it that of iron ship-building, as affording the most certain means of extending steam navigation from our own shores to the remotest parts of the earth, are well worthy the immediate and earnest attention of government.

It may be objected that two months for the average duration of voyages is an erroneous assumption, but if any other average be assumed, it will only affect the amount of £13,000,000 of saving, which we do not strictly insist upon as being exactly the correct amount which a more extended inquiry might verify. The principle, however, remains unquestionable,—that steam navigation, in carrying on the same commerce as that which now exists, will displace two-thirds of the capital at present employed in mercantile speculations; and whether this displacement shall amount to £13,000,000, more or less, and it certainly cannot be much less, the effect must be acknowledged as one of extraordinary value to every interest in this kingdom. Such being the importance of the iron ship-building question, the book before us cannot fail to be highly interesting to all classes of the community. The object of Mr. Grantham is "to institute an inquiry into the advantages to be derived from employing iron as a material for building ships, and to compare such vessels with those built of timber." The national and commercial considerations brought forward by Mr. Grantham in favour of iron ships are highly important; but in the eyes of professional men, and of practical men generally, the book will derive its chief value from the able manner in which the system of iron ship-building is described, and in which the comparison on practical points is instituted between ships of iron and those of wood.

\* She was built in 1821, and since that time many others have been built for foreign states.

Relating to the actual construction of iron vessels, the following subjects are most ably and yet concisely treated by Mr. Grantham: Keels—Stem and Stern Posts—Floorings—Side Frames—Gunnels—Mode of plating—Jointing—Single and Double Rivetting—Deck-beams—Bulkheads, &c. The following extracts from this part of the work will be found instructive, and will show the clearness and readiness of explanation with which Mr. Grantham has treated the subject.

"The floorings are first formed by a single or double bar of angle iron, to the vertical side of which a plain strip of iron, suiting the shape of the bottom, and extending from one bilge to the other, is rivetted; and on the upper edge of this strip a piece of angle iron is fastened, one side placed horizontally, to form a bed for the ceiling and kelsons. . . . The side frames or ribs are formed of angle iron, extending from the deck, and overlapping the angle iron of the floorings at the bilge, a length of 2 or 3 feet. To each, or to every other one of these ribs, another piece of angle iron is rivetted, in reverse position: to this last piece of angle iron the wood ceiling is bolted. . . . Plates of all forms and dimensions have, at various times, been used by different builders, from  $\frac{1}{8}$  to  $\frac{1}{2}$  of an inch in thickness, according to the size and required strength of the vessel. These are not, however, the limits within which the plates must of necessity be made; some of much greater strength will probably, in the further progress of the art, soon be in requisition. It is, I believe, generally acknowledged, that until of late the plates used for iron vessels have been much too light; but, as the subject becomes better understood, plates of greater strength are employed. On this branch of the subject a much greater difference of opinion is manifested than on that of 'framing'; the object of the latter being principally to preserve the form of, and to give stiffness to, the former. The impolicy of using light plates in the construction of a vessel is sufficiently obvious, for a few additional tons make an almost imperceptible difference in the draught of water, but materially increase the strength and durability of the ship. The scope which is afforded in iron vessels for increasing the strength of the framing is almost unlimited, and this by simple and evident means; but the question, as to the best disposition and proportionate strength of the plates, involves so many difficult and nice inquiries, that experience alone can satisfactorily determine it.

"*Jointing.*—There are two methods by which the plates are united: one of them is by bringing the edges of the plates together; a narrow plate or strip being placed inside to connect them by rivetting, thus forming a dush joint externally. The other method is by lapping the edges of the plates on each other, and rivetting them together. The former method corresponds with the carvel build, and the latter with the clincher build, of timber vessels. In both cases the position of the plates is longitudinal with the ship, as in wooden planking. Plates united with flush joints will evidently sustain the greatest strain arising from a force applied to or affecting their horizontal edges, for the weight is entirely removed from the rivets, and the supposed tendency to tear open those parts of the plates which are weakened by the rivet holes, will only apply to the vertical joints. With the lapped joints, on the contrary, nearly all the strain produced by a weight applied to the edge, or rather margin, of the plates, is thrown upon the rivets, with an apparent tendency to cut or shear them off in the middle of their length, or, in other words, in the centre of the lap; excepting in so far as this strain is counteracted by the frames,

(corresponding with the frames of a wooden vessel,) which, at short distances apart, cross these joints." From a consideration, however, of the nature of the strains to which vessels are liable, Mr. Grantham states that "the lapped joint appears to be preferable to the flush joint; and it is probable that if the former principle had invariably been adhered to, much trouble and expense would have been saved, as the flush plating seems to have originated in a mistaken idea that it increased the strength and improved the appearance of the ship.

**Bulkheads.**—Iron vessels admit of the very easy introduction of iron water-tight bulkheads. These are formed by plates riveted to the ribs or frames, both on the sides and bottom, each bulkhead making a complete transverse section of the vessel, and the whole being so secured as to prevent water passing from one side to the other. Several of these being introduced, divide the vessel into water-tight compartments. The bulkheads affording the greatest protection are those placed a few feet respectively from the stem and stern; the forward one checking the water that would enter through a damaged stem, and the after one averting the danger of any accident that might arise to the stern post and rudder braces. The water received in these small compartments would very slightly impede the way of the ship by throwing her out of trim, as the quantity they would contain would be comparatively trifling. The bulkheads more amidships are principally of service in giving strength to the vessel, but also afford safety in the event of fire, and prevent it spreading beyond the compartment in which it commenced. An ordinary leak, too, in one of them may be overcome, and no damage arise to the cargo or stores in those adjoining. These are advantages which it would be difficult to attain so effectually in a timber-built vessel." Relating to this part of the subject, the book contains a number of plates explanatory of the construction of iron vessels by means of details drawn to a large scale.

In considering iron vessels as a commercial question, Mr. Grantham insists forcibly upon the advantages which they possess in strength, combined with lightness—great capacity for stowage—safety—speed—durability—economy in repairs—cost—draught of water. Speaking of their durability, it is observed that "so slight is the apparent decay when the vessel is in use, and so much slower is its progress than is exhibited by iron when applied to other purposes in salt water, that many who have observed the fact, are led to suppose that some occult and preservative law is in operation, peculiar to iron so employed. A similar effect is said to be observable on the iron rails of a railway, the corrosion of which appears to be much less rapid when they are acted upon by carriages passing along them, than when they are lying in detached bars on the road side." This latter fact is readily accounted for, when we consider that it is usually only the upper web of the rail which is left exposed above the ballasting, and that the constant friction of wheels upon the top is sufficient to prevent any approach to oxidation, the tendency being rather to produce a polish on the top of the railway bar, than to allow it to become injured by oxidation. With respect to the occult law which some have imagined to operate in preserving the iron of vessels when in use, some light may probably be afforded by a fact with which we have been favoured by a correspondent, who observes on this subject, that the rusting or oxidation of iron in water takes place from the union of the oxygen of the water with the iron; and it is essential, in order that this union may take place, that the constituents

to be combined should be in a state of repose. Thus iron with a clean surface, immersed in a running stream, will not have its surfaces oxidized in any length of time, however great. Now, as iron placed in a running stream, and iron moving swiftly through the water, present the same conditions with respect to oxidation, the freedom of the latter from rust is no more than might be expected. This suggestion of our correspondent is confirmed by the fact, that iron ships when in dock, or elsewhere, in a state of repose, are as much subject to rust as other iron under ordinary circumstances. The question of the compass is ably handled by Mr. Grantham, whose observations upon the "Iron Duke" are sufficient to prove that the material of which she was constructed had nothing to do with the inaccuracy of her compasses.

Under the head of iron vessels, as a national question, are some highly important views, which, however, we have not space further to allude to. On a future occasion we may possibly recur to the subject.

*Practical Geodesy.* By Butler Williams, C.E., F.G.S., &c. London : Parker, 1842.

The process of measuring land by chain surveying is so perfectly simple, that a few weeks of practice in the field are sufficient for acquiring the knowledge of it, provided the pupil has been previously tolerably versed in geometry. To construct on the ground one or more large triangles, enclosing the whole or nearly the whole of the district to be measured, and afterwards to transfer these lines to paper, by simply describing a triangle when the three sides are given, constitutes that part of the survey which relates to the main lines or construction lines. Then, as a great deal depends upon the accuracy with which these main lines have been measured, it is absolutely necessary to verify such measurement by a series of lines intersecting two or more sides of the main triangles, and if the length of these lines, when laid down on paper in their proper position relative to the main lines, prove to be the same length as they measured on the ground, this is a proof that the whole have been accurately measured. The actual means of delineating on the paper the exact figure of the boundaries, buildings, and every object required for the purpose of the survey, are derived from the measurement of interior lines proceeding from one fixed point to another, which points must severally lie somewhere on the lines previously measured. Commonly, the interior filling-in lines are traced in the direction of the fences, or other boundaries, and as near to these as they can be set out; and measurements to the boundary being made by offsets from such lines, every part of the district is faithfully transferred to the paper plan by aid of the record of such measurements kept in the field-book.

It is evident that this system of measuring within main construction lines is infinitely superior to the practice of building up a series of small triangles one upon the other, and surveying by means of these each field separately from the beginning to the end of the survey. A multitude of errors will inevitably creep in where such a system is pursued, and the position of many objects and boundaries becomes, in consequence, greatly distorted, and incapable of rectification without a complete reconstruction of the work. Many of the old books on surveying, however, actually teach it according to this absurd and most unscientific system; and it is seldom we find, even in modern productions, the simple practice of

chain surveying so clearly and correctly explained as in the first chapter of Mr. Williams's Geodesy.

Chain surveying, however, though forming a very important practical part of the surveyor's labours, and although no one can be considered a good surveyor unless he is competent to measure land by means of the chain alone, constitutes by no means the whole of the geodesical knowledge which the surveyor should endeavour to acquire.

This leads us to observe, that the author of the work before us deserves the thanks of the whole profession for having introduced to their notice a variety of most important subjects, which have hitherto engaged very little of their attention. The chapter on Surveying, as applicable to the colonies—on Hill Drawing—on Levelling with the Mountain Barometer—on Mining Surveys—on Latitude and Longitude—and on Maritime Surveying, are of this class. They relate to subjects which are either entirely new, or which have been very imperfectly treated by former writers, and therefore Mr. Williams will be entitled to the full credit of having first aroused the attention of surveyors generally to these new sources of employment for their time and energies. The mere measuring of land is practised by so many persons, and is the subject of so much competition, that the prices have become quite inadequate to afford respectable remuneration to a professional man; and it is therefore high time that they whose capacity fits them should endeavour to make themselves masters of more advanced branches of field-engineering. These branches will be more extensively called for in proportion as the great mechanical improvements of the present age shall succeed in developing new sources and applications of power. Agricultural engineering alone, whenever it shall receive that attention from the land owners which its great importance demands, will require levelling operations of greater extent than any which this country has ever yet witnessed, and we shall hope to see, ere many years have elapsed, every square mile of cultivable land in this country delineated on maps with an uniform system of levels laid down upon the face of the superficial survey.

Mr. Williams's chapter on Surveying as applicable to the colonies, is principally derived from a report made by Captain Dawson, R.E., to the Secretary of State for the colonies in 1840. We quote the following sentences from this part of the work, as it will interest many surveyors to know the system of surveying which will be required in New Zealand and other new countries, where, from the absence of artificial boundaries and divisions of land, the object of the survey is entirely different from that which obtains in ordinary surveying. In a new country, in fact, the surveying consists not of the measurement of existing boundaries, but of the division of land into suitable blocks or figures, by means of certain lines which are to be laid down in connexion with the principal natural features of the country, as rivers and important chains of mountains.

"The resources of a new colony are evidently unable, on the one hand, to bear the burden of the expenditure necessary to obtain perfect accuracy; and, on the other hand, its thriving condition must be injured by the delay necessarily consequent on the operation.

"Perfect accuracy must, therefore, in the first instance be sacrificed to economy; and a method adopted capable of providing for the immediate division of the surface into suitable allotments, with an approximate accuracy, sufficient for the exigencies of the moment, and attained at the least possible cost.

"The square, or rectangle, admitted to be the figure best adapted for the subdivision of lands, is found to lend itself most readily to such objects. The size of these rectangular divisions or sections must depend on the means of the settler, and the agricultural capabilities of the soil. In Lower Canada the minimum size of the sections has been fixed at 200 acres; that adopted in South Australia contains 80 acres; and the greater number of the purchases in South Australia having been made of sections of the smallest size admitted by the regulations, it may be inferred that the average means of settlers would be more readily met by the smaller sections. Whatever may be the dimensions adopted, the mode of operation will be similar: it will be the first object of the survey to provide for setting out on the ground the limits of such sections, in the district selected as the most suitable for immediate settlement. The lines forming the boundaries of the rectangular sections are generally ranged in the direction of the cardinal lines; this ranging should be performed with the theodolite, the surveyor bestowing special care on the reading of the right angles, and never omitting to test the correctness of his work, by measuring the angles formed at the intersection of the boundary lines." Directions are given in another part of the book for determining the meridian line.

"The directions of these lines or boundaries of sections are ranged by the surveyor himself, while labourers are employed in clearing the lines, by cutting the brushwood or underwood to a width of about 3 or 4 feet.

"As the clearing proceeds, the boundaries of the sections are marked by strong pickets, driven into the ground, at short distances of a few hundred feet, and projecting above the surface not less than from 2 to 3 feet: the bark should also be taken off in order to render them more easily recognized. At the angular points of the sections, i. e., at the intersections of the boundary lines, three or more pickets should be driven, in order to distinguish especially those points in the boundaries. If the minimum size of the sections adopted be 80 acres, these pickets would be driven at every quarter of a mile, or at every twentieth chain of 66 feet. If the cardinal lines we have described have been arranged at a distance of one mile from each other, they will by their intersections form rectangles containing 1 square mile, or 640 acres." These squares would afterwards be subdivided into the assumed sections of 80 acres, by ranging across each four equidistant lines parallel to one pair of its sides, and across these again one central line parallel to the other pair of its sides. Thus, each section of 80 acres would be a rectangle of half a mile in length by a quarter of a mile in breadth.

The chapter on Hill Drawing opens up a subject almost entirely new to the profession in this country. The shading of hills on the magnificent ordnance survey of Ireland is not executed, as some have supposed, according to the mere dictates of taste, nor even of the unaided judgment; but, on the contrary, by means of a most interesting and ingenious application of mathematical principles. By means of the spirit level, the reflecting level, the theodolite, or some other instrument for levelling, a series of lines, perfectly horizontal, are traced at equal vertical distances from each other over the face of the country whose irregularities are to be represented on the map. Of course these lines will be more or less close to each other in proportion as the ground is more or less steep; and as the vertical distance between them is always constant, the incli-

nation at any particular place may at once be known by inspection of the horizontal distance on the plan. Mr. Williams terms the horizontal lines traced for this purpose, normal contours, and describes with great clearness and simplicity, the method of completing the shading of the map by means of the information which the contours afford. The author of a paper in another part of this journal has availed himself of the information in this chapter of Mr. Williams' book, to propose the application of normal contours to the ordinary surveys of land. (*See the Plate.*)

Levelling with the mountain barometer has not been extensively practised in England, on account of an impression that the results are not to be depended on. Undoubtedly, if great accuracy be sought, that is, if levels are to be carried over a country, and it be necessary to come within a few inches, or even within a few feet, of the truth, no instrument can be put into competition with the spirit level. Several long lines, however, have been levelled by the mountain barometer with an accuracy of which few would imagine it capable. The first survey of the Highlands of Scotland was made personally by Mr. Nimmo, under the directions of Mr. Telford, with the mountain barometer; and from the observations made in this preliminary survey the lines of the parliamentary roads were laid down. We have before us at this time a series of barometric levels taken across the country from York to Carlisle, and thence to Glasgow. These levels were checked by the known level of the Solway Firth at Carlisle, and of the Clyde at Glasgow, after passing in each case over a summit of 1000 feet in height, and no inaccuracy of more than 2 or 3 feet could be detected. An extensive series of levels was taken by the barometer for one of the lines of Brighton railway, to determine the most advantageous passes in the range of the South Downs, between Lewes and Shoreham. The levels were commenced from high-water mark near Brighton, and being carried back to the same point, proved to be accurate within less than 1 foot. As the variations in the height of the mercury can be observed in the mountain barometer, by means of its vernier, with sufficient accuracy to determine very minute differences of level, the principal point to be attended to is the guarding against error from sudden atmospheric changes, which of course alter the pressure upon the surface of the mercury. We propose to enter into the necessary details of this subject upon an early occasion, and in the mean time must be content with observing, that Mr. Williams has well explained the method of making the observations, and given correct practical rules for calculating the heights.

The chapter on Mining Surveys is useful and practical, and is accompanied by a specimen field-book, showing the method of making the observations in a subterranean survey.

The chapters on Latitude and Longitude, and on Maritime Surveying, are equally good with those we have noticed at length, but we have not space for quotations from them; nor indeed would these convey much information without being made at greater length than we should be entitled to borrow, in justice to the author. We cannot too strongly recommend the work to surveyors and students in every department of engineering—civil—military—and naval.

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*A Hand-book for the Architecture, Sculptures, Tombs, and Decorations of Westminster Abbey.* By Felix Summerly. London: George Bell, Fleet Street, 1842.

WRITTEN in a perfectly pleasing and popular style, abounding

in rich and beautiful description, and by no means wanting in the technical and professional accuracy which the architectural part of the subject requires, this little book deserves to be—what we have no doubt it will become—a general favourite with all classes of readers. Our space will not enable us to do justice to the work by a methodical review of its interesting descriptions, but we quote the following contrast between Grecian and Gothic architecture, as affording a favourable example of the author's architectural taste.

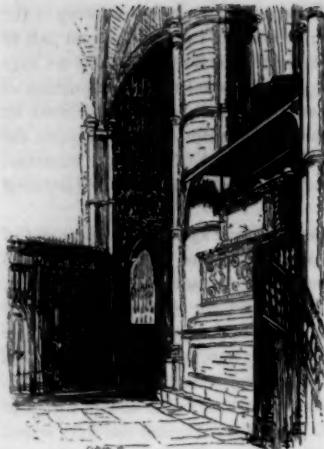
"In a Greek temple, the simultaneous and full development of its complacent and harmonious proportions, which admit of no addition or subtraction without injury, are essential to its full effect. Hence the Greeks raised their temples (like the Athenaeum on the Acropolis) on eminences best suited to display to most advantage their horizontal lines against the wavy outline of distant mountains. But principles diametrically the reverse prevailed with the ecclesiastical buildings of the middle ages, which rather sought exclusion than exposure, and broke, with tall pointed arches and lofty spires, the horizontal flats surrounding them. In them, splendour and impressiveness arise from an aggregation of details heaped one upon another, without much reference to a general design; increasing in magnificence as they increased in extent, and developing themselves gradually and not instantly. The vast height of our church buildings was a necessary connexion with the moral feelings of the times, aided by circumstances and climate. The lines of the structure devoted to the Christian Faith, pointing to the boundless blue above, were a fit, perhaps an inevitable, symbol of that faith which taught man to look from earth to heaven, and filled him with aspirations after an indefinable eternity. Then, not to omit the influence of material circumstances, if we look at an old plan of any of our cities, we find the church seemingly protected by houses close upon it, with little else to be seen save the spire, pointing upwards. Cities and towns, where cathedrals were built, were encompassed for safety by walls, and the space within was most valuable.

"The roofs, too, were acutely pointed, in order that they should afford the least possible retention of the constant rains and snows, as Mr. Hope has suggested. The churches marked their pre-eminence over surrounding buildings chiefly in height. If we take away the surrounding buildings, we not only lose a scale necessary for estimating the churches' elevation, but the eye sees at a glance, with disappointment, as finite, what was designed to appear infinite. The pointed spires and gables aimed to be impressive, too, by their height. But height is lost amidst great breadth, and this was forgotten when a large vacant area was made about the Abbey."

The book is illustrated by nearly sixty wood engravings of great beauty and effect, from which we have been permitted to select a few, which, in addition to their beauty as specimens of engraving, will possess considerable merit in the eyes of the architect.

We strongly recommend this hand-book to all who are ever likely to visit the venerable pile of Westminster, and to all who feel interested in its abounding beauties of art and taste.

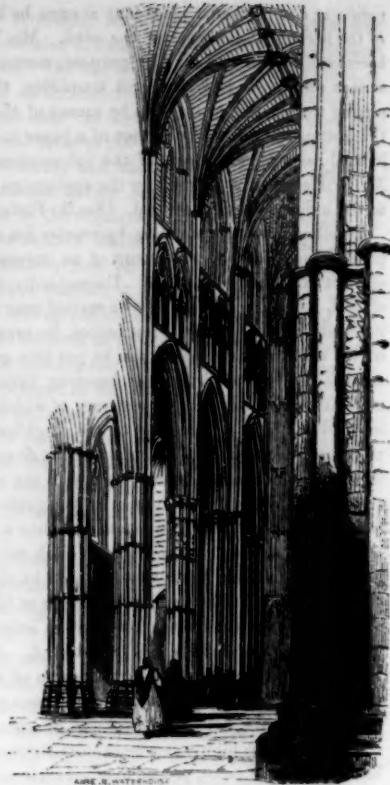
With this book in one's hand, more may be learnt, more curiosity gratified, and more amusement derived, from a single visit to the Abbey, than in a hundred visits where the parrot-like announcements of one of the official showmen of the place are the only guide within one's reach.



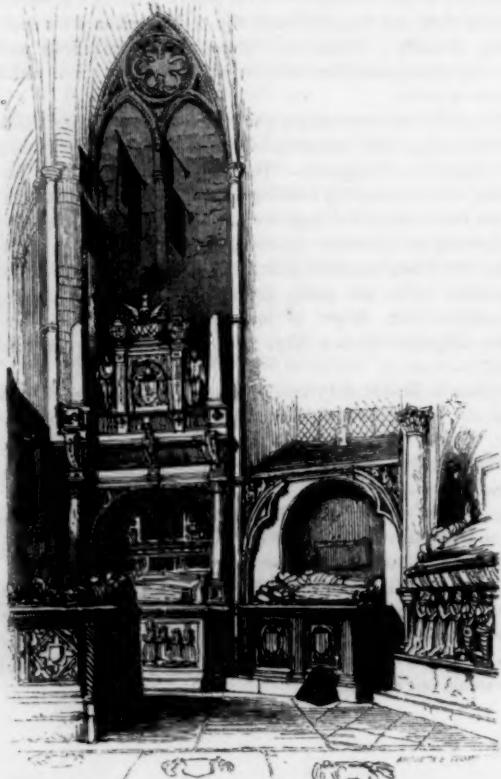
(View, eastward, from North Area.)



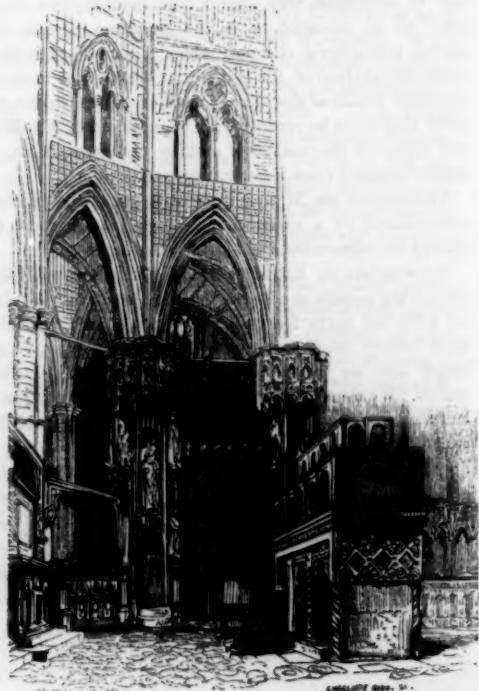
(View from St. John the Baptist's Chapel.)



(View in the Nave.)



(West Side of St. Paul's Chapel.)



(Edward the Confessor's Shrine.)

*Memoirs of the Literary and Philosophical Society of Manchester.*  
—Second Series, Vol. 6. London: John Weale, 1842.

THIS volume contains a series of most valuable and important papers, which have been read before the Society during the last ten years. Some of these are purely of a literary character, but there are others which will constitute additions of great value to practical science. In this class are the laborious and interesting experimental inquiries of Mr. Fairbairn, into the strength and other properties of cast-iron from various parts of the United Kingdom; with his experimental inquiry into the strength and other properties of anthracite cast-iron—Remarks on the coal district of South Lancashire, by James Haywood, Esq.—Mr. Dalton's observations on the Barometer, Thermometer, and Rain at Manchester, from the year 1794 to 1840 inclusive—Remarks on the Coal District of South Lancashire, by James Haywood, Esq. &c.—and the paper by William Rathbone Greg, Esq. on the Mural Architecture of Remote Ages, will be found highly interesting by those who possess any taste for antiquarian research.

Mr. Fairbairn's paper is particularly valuable from the immense accumulation of experimental results which he has determined, at a cost of no inconsiderable amount both of labour and money.

The first table contains the results of fifty-two experiments upon the deflection of cast-iron bars one inch square, and four feet six inches between the supports. In all these experiments the weight applied was 350lbs. and the mean deflection from the whole number of experiments was 1.051 inches. The kinds of iron used in these experiments were the produce of English, Welsh, and Scotch furnaces: the weakest, as shown by the greatest amount of deflection, being that from Ley's Works (an English iron) and the strongest that from the Beaufort Works in South Wales. The deflection of the bar from Ley's Works, was 1.524, as the mean of two experiments, and that of the bar from the Beaufort Works was 0.726. The former of these was a hot-blast iron of No. 1\* quality, on which Mr. Fairbairn afterwards remarks:—"Ley's Works, hot blast, is a weak iron as respects its breaking weight, but evidently stands well in its powers of resistance to the force of impact. . . . I should consider this a valuable metal for reducing the harder irons, and adapted for light work where strength is not required."

The quality of the Beaufort iron used in this experiment is not stated. It was probably No. 3, hot blast, a remarkably close and fine-grained iron. In taking 1.051 as the deflection of a bar of iron four feet six inches between the supports, and cast to be one inch square when loaded with a weight of 350lbs. in the centre, Mr. Fairbairn draws attention to the fact, that the bars cast to be an inch square, were invariably more than the exact inch both in depth and breadth. He observes, therefore, that the deflection would be something greater had the bars been exactly of the size by which they are designated.

\* No. 1, foundry iron is that which contains the greatest quantity of carbon. It is the most fluid kind of cast iron, and therefore best adapted for small and delicate castings.

No. 2, foundry iron contains less carbon than No. 1; is harder, closer grained, not so fluid when melted, and more regular in the fracture. This iron is most extensively used for castings of machinery, particularly where strength and durability are required.

No. 3, foundry iron contains still less carbon, and is consequently less fluid when melted than either of the preceding. It is very hard and tough, and well adapted for large castings where they are exposed to great wear and tear.—ED.

This we believe has been generally neglected by previous experimentalists, but Mr. Fairbairn in his subsequent tables throughout the inquiry, has given the exact dimensions of the bar, and afterwards reduced the weights applied to those which would be borne by bars exactly an inch square.

Mr. Fairbairn has given in great detail a long series of experiments upon English, Welsh, and Scotch irons, but as we propose to extract the valuable compendium of these results, we shall not encroach further upon his labours than to quote the following excellent and useful remarks on the comparison of the different kinds of iron.

"Before entering on the comparative estimates of the irons of British manufacture, I would offer a few remarks on the subject generally, as well as on those points which refer to the strength and other properties of the irons experimented upon. In order to ascertain their values, we must have some measure of comparison as respects their strength, fluidity, flexure, &c. I have already stated, that we may safely compare one iron with another, and that comparison will hold good when made between those of the same number and quality. We must, however, be careful of contrasting the No. 1 or first description of one iron, with the No. 3 of another. As regards strength, the No. 1 almost invariably exhibits greater weakness, accompanied with a greater degree of flexure than the No. 2 or No. 3. For example, the No. 1 Milton gives 352.5 for the breaking weight, and 1.525 for flexure; whereas the No. 3 exhibits 427.4 for the breaking weight, and 1.368 for flexure. Again, the Beaufort Nos. 2 and 3 present nearly the same difference, being in the ratio of 478.8 to 505.0 as regards strength, and as 1.512 to 1.599 in the measure of ultimate deflection.\* On the whole, therefore, it will be found, that the richer and more valuable descriptions of iron are, generally speaking, weaker, yet more ductile when exposed to heavy strains. They are also better adapted to those objects where the finer outlines and free working properties of the metals are required.

"In forming a judgment of the quality of a particular iron, there cannot, however, be any great risk, as we have only to look into the following table of collected results, and there will be found the strength as well as the properties of each. If, for instance, a strong compact iron was wanted, we have then to look at the number at the head of the list, and from 1 downwards to 15 will be found to partake of that character.—Again, suppose a moderately strong yet fluid iron was required, the numbers 16 down to 26 or 28, will more or less correspond with those qualifications. The same may be said of the lower numbers, all of which are a fluid and easy working class: they are admirably adapted for the finer descriptions of castings, when strength is not required, and must ever be in demand where that object is not considered of importance. In all these cases, it must, however, be admitted, that much depends upon using an appropriate mixture, and by judicious combinations to ensure the full value, and other properties necessary to be obtained in the act of casting. With these observations, a general summary of results, as obtained from the whole of the irons experimented upon, will now be exhibited.

\* There appears to be some error here, as the Beaufort iron No. 3, seems from the experiments to be in every way a stronger iron than the No. 2, and at the same time more ductile. The comparison between the Milton iron No. 1 and No. 2, exemplifies the remark, that No. 1 is generally the weaker iron, but capable of bearing a greater amount of flexure without breaking than the less carbonized specimens.—EDITOR.

**"GENERAL SUMMARY OF RESULTS OBTAINED FROM THE PRECEDING EXPERIMENTS ON RECTANGULAR BARS OF CAST IRON;**

*Each bar being reduced to exactly one inch square.*

In the following abstract, the transverse strength, which may be taken as a criterion of the value of each iron, is obtained from the mean of the experiments; first, on the long bars 4ft. 6in. between the supports; and next, on those of half the length, or 2ft. 3in. between supports. All the other values are deduced from the 4ft. 6in. bars.

Number of Irons in the scale of strength.	Names of Irons.	Number of Experiments on each.	Specific Gravity.	Modulus of elasticity in lbs. per square inch, or stiffness.†	Breaking weight in lbs. of bars 4ft. 6in. between supports.	Breaking weight in lbs. of bars 2ft. 3in. reduced to 4ft. 6in. between supports.	Mean breaking weight in lbs. (8.)	Ultimate deflection of 4ft. 6in. bars, in parts of an inch.	Power of the 4ft. 6in. bars to resist Impact.	Color.	Quality.
1	Ponkey, No. 3, Cold Blast	4	7.122	17211000	567	595	581	1.747	992	Whitish gray	Hard.
2	Devon, No. 3, Hot Blast*	2	7.251	22473650	537	—	537	1.09	589	White	Hard.
3	Oldberry, No. 3, Hot Blast	5	7.300	22733400	543	517	530	1.005	549	White	Hard.
4	Caron, No. 3, Hot Blast*	2	7.056	17873100	520	534	527	1.365	710	Whitish gray	Hard.
5	Beaufort, No. 3, Hot Blast	5	7.069	16802000	505	529	517	1.599	807	Dullish gray	Hard.
6	Butterley	4	7.038	15379500	489	515	502	1.815	889	Dark gray	Soft.
7	Bute, No. 1, Cold Blast	4	7.066	15163000	495	487	491	1.764	872	Bluish gray	Soft.
8	Wind Mill End, No. 2, Cold Blast	4	7.071	16490000	483	495	489	1.581	765	Dark gray	Hard.
9	Old Park, No. 2, Cold Blast	5	7.049	14607000	441	529	485	1.621	718	Gray	Soft.
10	Beaufort, No. 2, Hot Blast	4	7.108	16301000	478	470	474	1.512	729	Dull gray	Hard.
11	Low Moor, No. 2, Cold Blast	4	7.055	14509500	462	483	472	1.852	855	Dark gray	Soft.
12	Buffery, No. 1, Cold Blast*	5	7.079	15381200	463	—	463	1.55	721	Gray	Rather hard.
13	Brimbo, No. 2, Cold Blast	5	7.017	14911666	466	453	459	1.748	815	Light gray	Rather hard.
14	Apedale, No. 2, Hot Blast	3	7.017	14852000	457	455	456	1.730	791	Light gray	Stiff.
15	Oldberry, No. 2, Cold Blast	4	7.059	14307500	453	457	455	1.811	822	Dark gray	Rather soft.
16	Pentwyn, No. 2	4	7.038	15193000	438	473	455	1.484	650	Bluish gray	Hard.
17	Maesteg, No. 2	5	7.038	13959500	453	455	454	1.957	886	Dark gray	Rather soft.
18	Muirkirk, No. 1, Cold Blast*	4	7.113	14003550	443	464	453	1.734	770	Bright gray	Fluid.
19	Adelphi, No. 2, Cold Blast	5	7.080	13815500	441	457	449	1.759	777	Light gray	Soft.
20	Blaina, No. 3, Cold Blast	5	7.159	14281466	433	464	448	1.726	747	Bright gray	Hard.
21	Devon, No. 3, Cold Blast*	4	7.285	22907700	448	—	448	.790	353	Light gray	Hard.
22	Gartsherrie, No. 3, Hot Blast	5	7.017	13894000	427	467	447	1.557	998	Light gray	Open.
23	Frood, No. 2, Cold Blast	5	7.031	13112666	460	434	447	1.825	841	Dark gray	Soft.
24	Lane End, No. 2	3	7.028	15787666	444	—	444	1.414	629	Dark gray	Stiff.
25	Carron, No. 3, Cold Blast*	5	7.094	16249666	444	443	443	1.336	593	Gray	Soft.
26	Dundavon, No. 3, Cold Blast	4	7.087	16534000	456	430	443	1.469	674	Dull Gray	Rather soft.
27	Maesteg (marked Red)	5	7.038	13971500	440	444	442	1.887	830	Bluish gray	Fluid.
28	Corbyns Hall, No. 2	5	7.007	13845866	430	454	442	1.687	727	Gray	Soft.
29	Pontypool, No. 2	5	7.080	13136500	439	441	440	1.857	816	Dull Blue	Rather soft.
30	Wallbrook, No. 3	5	6.979	15394766	432	449	440	1.443	625	Light gray	Rather hard.
31	Milton, No. 3, Hot Blast	4	7.051	15852500	427	449	438	1.368	585	Gray	Rather hard.
32	Buffery, No. 1, Hot Blast*	3	6.998	13730500	436	—	436	1.640	721	Dull gray	Soft.
33	Level, No. 1, Hot Blast	5	7.080	15452500	461	403	432	1.516	699	Light gray	Soft.
34	Pant, No. 2	5	6.975	15280900	408	455	431	1.251	511	Dull gray	Rather hard.
35	Level, No. 2, Hot Blast	6	7.031	15241000	419	439	429	1.358	570	Light gray	Soft.
36	W. S. S., No. 2	5	7.041	14953333	413	446	429	1.339	554	Light gray	Soft.
37	Eagle Foundry, No. 2, Hot Blast	4	7.038	14211000	408	546	427	1.512	618	Bluish gray	Soft.
38	Elsicar, No. 2, Cold Blast	4	6.928	12586500	446	408	427	2.224	992	Gray	Hard.
39	Varteg, No. 2, Hot Blast	4	7.007	15012000	422	430	426	1.450	621	Whitish gray	Rather soft.
40	Coltham, No. 1, Hot Blast	5	7.123	15510066	464	385	424	1.532	716	Gray	Hard.
41	Carroll, No. 2, Cold Blast	4	7.069	17036000	430	408	419	1.231	530	Bluish gray	Soft.
42	Muirkirk, No. 1, Hot Blast*	4	6.953	13294400	417	419	418	1.570	656	Dark gray	Soft.
43	Bierley, No. 2	5	7.185	16156133	404	432	418	1.222	494	Bright gray	Soft.
44	Coed-Talon, No. 2, Hot Blast*	4	6.969	14322500	409	424	416	1.882	771	Gray	Rather soft.
45	Coed-Talon, No. 2, Cold Blast*	5	6.955	14304000	408	418	413	1.470	600	Bluish gray	Soft.
46	Monkland, No. 2, Hot Blast	3	6.916	12259500	402	404	403	1.762	709	Bluish gray	Soft.
47	Ley's Works, No. 1, Hot Blast	3	6.957	11539333	392	—	392	1.890	742	Bluish gray	Soft.
48	Milton, No. 1, Hot Blast	4	6.976	11974500	353	386	369	1.525	538	Gray	Soft and fluid.
49	Plaskynaston, No. 2, Hot Blast	5	6.916	13341633	378	337	357	1.366	517	Light gray	Rather soft.

The irons with asterisks are taken from the Experiments on Hot and Cold Blast Iron, made by Mr. Hodgkinson and myself for the British Association for the Advancement of Science.—See Seventh Report, Volume VI.

† The modulus of elasticity was usually taken from the deflection caused by 112 lbs. on the 4ft. 6in. bars.

## RULE.

To find from the above table the breaking weight in rectangular bars, generally, calling  $b$  and  $d$  the breadth and depth in inches, and  $l$  the distance between the supporters in feet, and putting 4.5 for 4ft. 6in., we have  $\frac{4.5 \times b d^2 S}{l}$  = breaking weight in lbs.—The value of  $S$  being taken from the table above.

For example: What weight would be necessary to break a bar of Low Moor Iron, 2 inches broad, 3 inches deep, and 6 feet between the supports? According to the rule given above, we have  $b=2$  inches,  $d=3$  inches,  $l=6$  feet,  $S=472$  from the Table. Then  $\frac{4.5 \times b d^2 S}{l} = \frac{4.5 \times 2 \times 3^2 \times 472}{6} = 6372$  lbs., the breaking weight."

In his inquiry into the strength and other properties of anthracite cast iron, Mr. Fairbairn has extended his valuable experiments to the various kinds of Welsh iron made from anthracite coal, a branch of the manufacture which has been extensively carried on

in South Wales since the introduction of the hot blast. The following Table, exhibiting the results of these experiments, may be taken as a continuation of the preceding:—

Number of Iron in the scale of strength.	Names of Irons.	Number of Experi- ments on each.	Specific Gravity.	Modulus of elas- ticity in lbs. per square inch.	Breaking weight in lbs. of bars 6in. between supports.	Breaking weight in lbs. of bars 2ft. dia. between supports.	Mean breaking weight in lbs. (S.)	Ultimate deflection of st. 6in. bars, in parts of an inch.	Power of the st. 6in. bars to re- sist impact.
1	Ynisedwyn, No. 3.	.	5	7.168	16,194,327	515	525	520	1.525 785
2	" " 2.	5	7.095	15,334,000	485	532	508	1.529 709	
3	Ystalyfera " 3. 2nd ditto	.	4	7.352	18,391,425	502	—	502 } Mean	1.324 665 } Mean
4	" " 3. 1st ditto	.	6	7.133	13,436,806	457	425	441 } 472	1.825 837 } 751
5	" " 2. 2nd ditto	.	4	7.258	15,686,750	481	—	481 } Mean	1.505 728 } Mean
6	" " 2. 1st ditto	.	6	7.053	13,973,270	453	454	654 } 468	1.788 810 } 769
7	Yuiscedwyn " 1.	.	6	7.078	13,741,400	453	464	458	1.730 785
8	Ystalyfera " 1. 1st sample	.	5	6.992	11,555,635	435	423	429 } Mean	2.252 973 } Mean
9	" " 1. 2nd ditto.	4	7.098	14,044,420	392	—	392 } 410	1.445 569	771

(To be continued.)

*A Dictionary of Greek and Roman Antiquities.* Edited by William Smith, Ph. D. 8vo. 1121 pp. London, Taylor and Walton, 1842.

THE study of antiquities can never lose that interest by which it is distinguished amongst the more reflective and philosophical of mankind. With such it will ever be a source of high and permanent enjoyment to turn aside for a few hours from the noisy and jarring world without, to dwell with calm yet interested contemplation upon the tastes and pursuits, the manners and habits, the wants and enjoyments of myriads of human beings, who in far distant ages ran through their infinite variety of career—from the cradle to the grave—subject to the same natural laws, and possessing the same undying spirit as that which breathes in their descendants through all generations.

They have long since lived and died—those heroes of antiquity—their bones have bleached upon a thousand plains, the ravages of every element have not been wanting to effect their utter obliteration from before the eyes of posterity—yet are they not forgotten; yea, rather they are remembered—some with the glowing enthusiasm which prompts to the imitation of the virtuous and the noble—others with the scorn which follows in the wake of meanness and of vice—all in the separate and appropriate channels which the records of history have chalked out on the map of the world's judgment. While all former generations of inferior animals have perished without leaving behind them one trace of constructive design to attest their successive existence on the earth, it has been reserved for man to rear, in all ages, monuments of skill and art,

wherein his most remote descendant may read and study the history of his long-departed ancestor.

In those great storehouses from which the labours of geology have brought to light so many remains of former worlds, we find the most delicate tissues of animal and vegetable life preserved amidst masses of the hardest and most inflexible mineral substances; but throughout the whole of these no trace of man or of his works appears, and the vast accumulation of inferior organic remains is nowhere interspersed with any thing which has either belonged to the body of a human being, or been formed by the effort of a human exertion. No sooner, however, do we pass the limit of the last terrestrial creation, than we find the earth strewed with the monuments of human greatness—her folly, pride, ambition, and the other passions, which, while they work effects of terrific evil at the time, and amongst the people which give them birth, are yet, under the guidance of incomprehensible wisdom, bent into the most admirable subservience to that grand advancement of the human race which is witnessed by every successive century in the age of the world.

Thus, while nature has recorded the history of all inferior races—and this even through a succession of former worlds, man alone has been permitted to write his own history—scarcely less legibly, and certainly not less forcibly, through the medium of his monumental remains, and the ruins and relics of his genius and constructive enterprise, than in the written language of tablets and books.

Apart from all its value to the arts, when we thus consider the study of antiquities as affording the most truthful and philosophical records of the world's history, we shall not wonder at the unbounded

enthusiasm with which some of the most superior intellects have engaged in the researches of antiquarian literature, and the pursuit of antiquarian remains. If it has ever been that men of active and enterprising genius have looked with some approach to contempt or indifference upon the labours of the antiquary, the fault of this must be sought, not in the nature of the pursuit itself, but in the dry and abstract manner in which antiquities have been studied, without the variety of any sensible representation of the beautiful remains of art which it has not failed to bring to light. If it were attempted to draw one grand division line, through all departments of human knowledge considered as one mass, and to separate on the one hand all that is useful, ennobling, and worthy of engaging intellectual attention, from all that is useless, and mystifying, and unphilosophical, we should cleave in twain most of the sciences, and the study of antiquities would be one of them. Such a line would be drawn just where a mere encumbering mass of words—albeit sometimes learned and sounding enough, came to be substituted for ideas; just there would be the boundary between the two kinds of knowledge, the one of which will languish in proportion as the world grows old in wisdom and resources, while the other will add to the stores of that wisdom, and aid in the developement of those resources.

The matchless productions of genius which the golden age of art in Greece and Rome gave to the world, will ever be the admiration of all enlightened nations. There are models of unrivalled beauty for the sculptor, gems of rare and exquisite workmanship for the engraver, and abundant studies of grace and beauty for the painter. The book before us is not a mere dry catalogue of classical names and things, with dry abstract descriptions; but a series of exceedingly well and elegantly written articles upon every interesting subject of Greek and Roman antiquities, illustrated by an immense assemblage of admirable wood engravings. Thus every facility is afforded to every class of readers for the study of antiquities, while the names of the contributors to the work furnish the best possible guarantee for the sound and accurate knowledge of each department which every page of it displays. The talented and accomplished Editor has himself contributed very extensively to the work; and he has been assisted by a host of eminent men, whose names are given, and whose initials are affixed to their respective articles. The Dictionary is arranged alphabetically, and few words have been omitted which relate at all to Greek and Roman antiquities. It is not, however, the place to study the mythology, nor the biography and geography of the ancients—these are departments which the Editor alludes to as the subjects of future dictionaries. Most of the readers into whose hands this review will fall, will no doubt prefer the Dictionary for its freedom from such purely literary subjects as these; and it will be amply compensated by the fact, that "considerable space has been given to the articles on Painting and Statuary, and also to those on the different departments of the Drama."

The work may be taken as a valuable addition to the labours of Potter, Adams, Lempriere, Barker, Anthon, Robinson, and Dymock: well calculated, as far as we have been able to compare it with the works of those authors, to supply the defects in their writings.

To the classical student we need not say one word on the value of such a book; but we are persuaded the varied and useful information here contained upon the laws, the customs, the pursuits, and military skill of the once great and powerful Greeks and Romans, will be not less valuable to the architect and the general student.

We have not space in this number for an extract, but shall be able next month to lay before our readers some of the rich and varied stores, which have been collected from the best and most valuable sources of information.

*The Official Map and Section of the South Eastern Dover Railway.  
Jobbins, Warwick Court, Holborn; and J. Weale, Holborn.*

It will be known to many of our readers, that the Directors of several of the principal railways have caused district maps to be prepared, showing the connexion of the adjacent country with their respective lines. Such maps, being engraved in excellent style, and reduced from the best possible authority—the ordnance survey—form valuable additions to the topography of the country, at the same time that they are interesting in a peculiar degree to the proprietors of shares in railways, as exhibiting the national and commercial relations of the whole district within the influence of their particular line.

We need scarcely say it is a great advantage to the public that they are able thus to obtain a valuable map for a price considerably below what would remunerate the proprietor, were it not that the expense of drawing and engraving is partly borne by the parties who require the maps for a special purpose. To every one who has occasion to travel by railway, these maps are highly useful, and very superior to those on a less scale, and with less pretensions to accuracy, because every existing mode of communication, both by land and water, is most accurately delineated, on a scale sufficiently accurate for determining distances within 100 yards. This approach to accuracy depends of course on the scale of the map; in stating this as the limit of error in the measurement of distance, we speak of maps constructed on the scale of the one now before us, namely, one-third of an inch to a mile. Judging from a very correct personal knowledge of the district comprised in the official map of the South Eastern Dover Railway, we can testify to its great accuracy and copiousness of detail. We should not omit to notice a feature in this map which will recommend it to the notice of engineers, and in fact increase its value in the eyes of all who have ever taken the trouble to understand what is meant by the section or profile of a line of country—namely, that the sections of the several railways, in connexion with the South Eastern line, are separately laid down on the map. Thus the levels of the country on the entire route of the railway are seen at a glance, as well as the rates of inclination of the several gradients on the whole line from London to Dover. Part of the coast of France is shown on the map, with the distances across the channel from port to port.

We have never seen so correct and generally useful a map published at so small a price.

*A Longitudinal Section of a Locomotive Engine and Tender, with Descriptions for the Use of Schools and Students. Bell and Wood.*

THIS is a very successful attempt to show by a drawing on rather a large scale, with a copious reference to all its component parts, the entire construction and operation of this wonderful and highly important machine. There are few persons—however unacquainted with that apparently occult mechanism by which the ponderous mass of a railway train is whirled along—who may not acquire a

pretty accurate knowledge of this most splendid application of steam power, by attentively tracing its action through the medium of the drawing and its accompanying description.

In colleges of engineering, and in schools where the ordinary routine of education is accompanied by more or less of scientific instruction, this history of a locomotive engine cannot fail to be a desirable and valuable acquisition, both to the teacher and the pupil.

#### MR. SMITH'S LECTURE ON PROJECTION.

ON Wednesday, the 8th of June, Mr. J. Smith, of the Royal Polytechnic Institution, delivered a lecture on Projection, at the Society of Arts, Adelphi, in which he fully explained and illustrated the principles and practice of drawing the representation of objects according to the several systems of projection.

After some preliminary observations, in which the importance and advantages of drawing were forcibly pointed out, the Lecturer proceeded :

" I define projection to be that art by which we are enabled to draw the representations of objects upon a plane surface according to a given law. The four common systems of projection—orthographical, isometrical, military, and perspective—may be divided into two classes, under the heads of parallel and converging projection : of which orthographical, isometrical, and military projection will be included under the term of parallel projection ; and perspective projection under that of converging.

" In the practice of orthographic projection, the objects are assumed to be on a plane surface, either inclined at right angles to the picture, or parallel to it, and their representations are drawn as if formed by parallel lines or rays issuing from them, inclined at right angles to the picture.

" When the representation of an object is assumed to be drawn as if formed on a plane at right angles to its base, it is called an elevation of it; and when drawn as if formed on a picture placed parallel to its base, it is called a plan of the same.

" In the practice of isometric projection the objects are assumed to be on a plane surface, inclined to the picture at an angle of  $54^{\circ} 44'$ ; and their representations are drawn as if formed by parallel lines or rays issuing from them, inclined at right angles to the picture.

" In the practice of military projection the objects are assumed to be on a plane surface, inclined at right angles to the picture ; and their representations are drawn as if formed by parallel lines or rays issuing from them, inclined at an angle of  $45^{\circ}$  to the picture, and to the plane surface on which the objects are placed."

The Lecturer, when alluding to the practice of the preceding systems of parallel projection, clearly illustrated the principles of each by means of a small frame, within which he placed an original object in the form of the geometrical solid called the wedge. On one side of the frame was fixed a plate of glass, inclined at right angles to the base of the object, and having on it the orthographic elevation of the wedge ; and in the top of the frame was a second plate of glass placed parallel to the base of the object, having on it the orthographic plan of the wedge. Adjoining the first plate of glass was another inclined to the base of the object, at an angle of

$54^{\circ} 44'$ , having on it the isometric elevation of the wedge ; and lastly, opposite and parallel to the first plate of glass another was fixed, on which was drawn the military elevation of the wedge.

Mr. Smith proceeded : " From these simple illustrations of the manner in which the representation of this object is assumed to be formed, you will readily comprehend what is meant by the term 'representation of an object,' and will not mistake the expression for that of the 'appearance' of an object. By the appearance of an object we can only understand the sensation or feeling produced on the mind through the organs of vision ; whereas, by the representation of an object, we are simply to understand the figure or combinations of figures that are assumed to be formed on the picture by lines or rays issuing from them according to some given or determined law.

" We now come to perspective projection. This is the art of drawing the representations of objects upon the picture, which objects are always assumed to be on a plane inclined at any angle, or parallel to it ; so that right lines proceeding from the various parts of objects, towards a given point without the picture, may intersect the corresponding parts of the representations drawn upon it. Hence, in the practice of perspective projection, the objects are assumed to be on a plane surface, inclined in any degree, or parallel to the picture ; and their representations are drawn as if formed by converging lines or rays issuing from them towards a given point without the picture."

The Lecturer here illustrated the principles of perspective projection by means of a fifth plate of glass fixed in the frame before alluded to, and on which was drawn the perspective elevation of the wedge. He then continued :

" Allow me now to draw your attention to a peculiarity in the terms by which I have defined the various systems of projection, which it has been my endeavour to explain and illustrate by means of this simple object and its representations ; that is, that I have never alluded to the eye or eyes, or to the position of the eye, in relation to this object. Now, it must be well known to many before me, that our general and common writers on orthographic, isometric, and perspective projection, almost invariably introduce the eye into their definitions of those terms, particularly in that of perspective\* ; thus, the celebrated Dr. Brook Taylor, in his original work entitled Linear Perspective, 1715, writes, 'Perspective is the art of drawing on a plane the appearances of any figures, by the rules of geometry. In order to understand the principles of this art, we must consider that a picture, painted in its utmost degree of perfection, ought so to affect the eye of the beholder, that he should not be able to judge whether what he sees be only a few colours laid artificially on a cloth, or the many objects there represented, seen through the frame of the picture, as through a window.' Again, even so late as the year 1822, we find that the talented Peter Nicholson, in his Rudiments of Practical Perspective, ed. 1822, thus writes : 'Perspective is the art of representing any object upon a plane surface, so that, when seen from a certain point, the representation shall appear similar to the object itself, when the spectator's eye is fixed in the real point of view.'

" From these quotations you learn that these writers boldly assert, yet never prove, that the perspective representations of any original object ought to present the same appearance to the eye of the beholders as would be derived from viewing the original

\* In the Introduction to the Drawing-book lately published by Mr. Weale, will be found a strictly mathematical definition of the different kinds of projection, entirely without reference to the eye.—ED.

object; that is, any individual on viewing this model of a house with one eye from this position, would have a certain appearance of it presented to view. Now, assuming this to be a perspective representation of the model, drawn as if formed by lines or rays issuing from it to this position or point of view, then, according to the opinion of those writers, ought this representation also to present an appearance similar to that formerly obtained in viewing this model or original object.

" Shall we assent to this bold and rash assertion?—how stands the case?—simply thus: our writers on perspective seem merely to have defined their system in that manner in which it has now for centuries past been commonly understood, without once troubling themselves as to the truth of it.

" To avoid the errors of former writers and teachers, I have been induced to refrain from introducing the eye in connexion with the principles of perspective, or of any other system of projection; so that I might be enabled to treat these arts on strictly geometrical principles: for I consider that the perspective representations of objects, as also those executed according to the principles stated in orthographic, isometric, and military projection, are merely to be considered as mathematical descriptions of them; although I must admit, as I have before done, that to me the perspective representations of objects do present an appearance more like the original objects than any other representations of them, as determined by any other known system of projection."

The Lecturer here proceeded to illustrate the various methods of placing the picture that have been recommended by writers on perspective.

The Lecturer then arranged a novel, compact, and portable apparatus, by which he exhibited for the first time a series of dissolving views, which he has prepared to illustrate his future popular lectures on perspective and artistic drawing.

We have taken the liberty of considerably abridging this lecture, and particularly of omitting all that related to artistic drawing, which branch, however, was treated with as much ability as the parts of the subject which we have quoted. The lecture throughout was deservedly listened to with marked attention by the numerous and highly respectable audience present on the occasion. Mr. Smith possesses considerable merit and originality, and we have reason to know that his pupils are equally gratified and astonished at the progress they have made under his instructions.

#### PROFESSOR COWPER'S LECTURE AT THE ROYAL INSTITUTION.

THIS lecture was delivered on Friday evening, June 3rd. The Professor commenced by stating that he was induced to draw their attention on the present occasion to the slide rest principle, in consequence of its being the means of very greatly tending to improve machinery.

The invention and first adoption of this principle he believed to be due to the late Mr. Henry Maudsley, when employed in Mr. Bramah's establishment; and he had only to allude to the lathes formerly in use, and those now constructed on the slide rest principle, to show what an important improvement this was. He described the pole-lathe to be constructed of two beams of timber,

which were laid horizontal, with a small opening, so that the poppet-heads might move between; the mandril worked in the two wooden poppet-heads, which were generally faced with plates of iron. He would not longer occupy their time with the description of so rude an apparatus, which was familiar to most persons, but would, however, remind them that it was not very long out of use. He had now great pleasure in bringing before them Messrs. Whitworth & Co.'s lathe, and also their ploughing and drilling machines, which he might almost term self-acting, the most inexperienced workmen being able to use them. In order that his audience might properly understand the principle of these invaluable machines, he would dwell for a short time on the slide rest, or guide principle. It had been called, by Mr. Nasmyth, the slide rest principle, whereas Mr. Holtzapfel had termed it the guide principle; he would, from the model before them, endeavour to explain the way in which the slide rest acted. The machine consisted of two motions, one parallel to the axis of the piece of wood or iron to be turned, the other perpendicular to it. It was evident that the old T rest was not applicable to turning anything true, as the tool was merely guided by the hand of the workman. The mode now adopted for copper-plate ruling was on the slide rest principle; in fact, this improvement had not only been introduced in machinery, but he might also allude to its having been adopted by the masons for setting stones; he would refer, as an instance, to the monument now erected in Trafalgar Square, where a crab engine was placed on a strong wooden frame with wheels, and was moved the whole length of the scaffolding on a small tram-way laid down for the purpose; but the crab itself also had wheels, so that it was easily moved to and fro on its wooden frame in a direction perpendicular to the former: the advantage of this mode over the one in use twenty or thirty years ago, was evident. Instead of having two large posts secured by ropes, and requiring a great number of men to manage it, and after all being limited in its scope, the operation was now performed with the greatest ease and accuracy by three or four men, who have only to roll the crab over the cart, which brings the stone to the work, draw it up by the winch, and roll the crab back over the place in which the stone is to be set. Numerous other instances might be adduced equally ingenious, but time would not at present permit him to go into them.

The Professor then showed the accuracy with which machinery was now made, owing to the slide rest principle; and had on the table numerous specimens of the excellence to which Whitworth and others had attained in cutting screws, planing surfaces perfectly true, making a piston to fit a small cylinder air tight, &c. We noticed particularly two cast-iron surfaces, which had been so accurately planed as to float on one another; these were from Messrs. Whitworth's establishment: there was also in the room a planing-machine on the slide-rest principle, and of the most improved construction, the tool being fixed, whilst the work moved to and fro; the peculiarity in the construction being the revolution of the tool on its axis, so that it always presented its cutting edge to the work; these were also of Whitworth's construction.

We were also much pleased to see Professor Leslie's apparatus for cutting the teeth of wheels, which was for a short time set in action, and seemed to perform well.

The Professor then gave a description of the drilling machines formerly in use, and which were superseded by the almost self-acting apparatus manufactured by Whitworth: he described the old plan of drilling iron with the common brace, which was turned

round by the hand of the workman, and which it was evident was not calculated to perform accurately.

The Professor concluded by remarking, that every person ought to be acquainted in some degree with the principles of machinery, as cases were every day brought before juries relating to infringement of patents, and to other subjects, rendering some knowledge of machinery absolutely necessary on the part of all concerned in such cases.

In this opinion all must agree, and it is an advantage by which professional students in the present day are highly favoured, that they are able to improve the time not actually employed in the office by listening to such instructive lectures as the one of which we have given a brief abstract. On a future occasion, we hope to do more justice to Mr. Cowper's lectures.

#### WOOD PAVING IN LONDON AND THE PROVINCES.

THE following are the prices charged by the several companies and patentees who have hitherto laid down specimens:—

	s. d.
Mr. Stead's system of hexagonal prisms, 6 inches in depth, per square yard	9 0
The Count de Lisle's system (of parallelopipeds, with one pair of planes vertical, another pair horizontal, and the third pair also parallel, and inclined at an angle of about $63\frac{1}{2}$ degrees), adopted by the Metropolitan Company, for 6 in. blocks and concrete complete, per yard	13 0
For 5 in. blocks, including concrete	12 0
For 4 in. blocks	11 0

This company also undertakes to keep the wood paving in repair, at the rate of 6d. per square yard per annum, for terms of ten or twenty-one years.

Mr. Carey's system of large cubical blocks, the base and surface of parallel planes, and the sides alternately concave and convex, for blocks of 8 in. in depth	12 6
9 ditto	13 6
10 ditto	14 6

No concrete foundation is used for this kind of paving.

Mr. Grimman's system of blocks with one pair of horizontal planes and two pairs of opposite parallel planes, both inclined to the base at an angle of 77 degrees, 12s. per square yard, including concrete.

The following account of the Count de Lisle's system, which has already gone far a-head of all the others, the Metropolitan Company having laid down nearly double as much paving as all the others put together, is taken from Mr. Stevens's useful little pamphlet\*, in which the merits of all the various kinds of wood-paving are explained with much clearness and candour:—

Cohesion is effected, in this system, by a mode equally scientific and simple. The blocks, 6 inches deep, and 6 inches square at the base and top, are parallelopipeds, which, on two parallel sides, are perfectly vertical, and on the other two incline at an angle of 63 degrees, 26 minutes, 5 seconds, and  $\frac{1}{10}$ ths of a second, being the precise angle obtained by a process, termed, by the inventor, the stereotomy of the cube. These blocks are cut and drilled by machinery mathematically alike; and are so placed in the street, that the blocks rest upon and are supported by each other, from kerb to kerb, each alternate course having the angle of inclination in opposite directions. These courses are connected to each

other, side and side, by dowels, which dowels occupy the exact centres of two isosceles triangles, into which each block is divisible. This arrangement affords the means of connecting every block with four others; and prevents the possibility of one being forced below the level of another. Pressure and percussion are therefore distributed, in effect, over large surfaces, and a perfect cohesion established. Nor is this cohesion advantageous only as a means of resistance against superincumbent force. It is of equal value in withstanding any effort to break up the uniformity of surface by undue expansion. The concrete foundation having a slight elliptical curve given to it, and the wood paving being so laid as to correspond with that curve, for the purposes alike of strength and surface drainage, there is naturally a slight tension on the dowels in an upward direction, which the pressure from above tends to relieve; whilst the lower ends of the blocks abut so closely together in one direction, and every block is so kept in its position by two dowels on each side, in the other direction, that the whole mass will take any increased curve consequent upon expansion, without the slightest risk of either partial or general displacement.

Facility in laying down, and for removals and replacements, has been attained in this system by progressive improvement. The first two specimens, those at Whitehall and Oxford Street, and part of Coventry Street, were laid in a continuous mass across and lengthwise of the street; but, in the other part of Coventry Street, and in all subsequent contracts, a striking improvement has been introduced, although mainly provided for in the specification of Mr. Hodgson, the patentee. It consists in dovelling the blocks together at the manufactory, in panels of 24 each, 6 in length by 4 in width, the blocks at the sides of which are connected together by iron cramps. Thus prepared, the process of covering the surface of a street is exceedingly rapid and simple. One end of a panel is cut off at an angle to agree with that of the kerb, and the curve of the street, and is then abutted against it; each panel containing four courses, in alternate angles, another fits in or dovetails precisely with the first, and thus panel after panel is laid until the street is crossed, and the last cut off to abut against the other kerb. So that the work is continued in courses of panels, instead of courses of blocks. Besides such facility of laying, there arises a still greater advantage from this improvement, in the ease with which any part can be removed and re-placed for the purpose of repairing sewers, gas and water pipes, &c.

As respects the disposition of the fibre of the wood, it takes, in this system, as near as can be, the angle at which the blocks incline. So placed, the weaker fibres are supported by resting upon the stronger, in the same way that block rests upon block; and they are in no case liable to such destruction from abrasion, pressure, or percussion, as if they were vertical; whilst they yield all the advantages of superior elasticity. It is not assumed that this precise angle of the fibre is the only one that can be held to be superior to the vertical; other angles may possess the same quality in greater or less proportion. Nor is it alleged that the advantages clearly derivable from an inclined fibre were premised in the original design of the Count de Lisle's system; they are consequent upon his peculiarity of construction, in itself of the utmost importance, but they are not the less to be appreciated on that account.

And, lastly, with reference to grooving the surface of the blocks, this system is susceptible of any improvement which experience might demonstrate to be necessary, but to which a limit can already be assigned. At Whitehall, and in Oxford Street, the two first specimens, the blocks were grooved in parallel lines, somewhat less than 6 inches apart, only from side to side of the street. This, there is little doubt, offered sufficient foot-hold to the horse for forward propulsion; but gave no points of resistance in case of slipping or turning towards either side. To obviate the latter, all subsequent specimens, beginning with that in Fores Street, City, have been cross-grooved; that is to say, lengthwise, as well as across the street; and complaints of slipperiness—in all cases far exceeding their real amount—have proportionately decreased. In Regent Street, the cross-grooving has been cut much deeper than usual, the advantage of which has yet to be seen; whilst its disadvantage, of inducing the formation of ruts in the longitudinal grooves, has been provided against, by a mode of breaking the joinings of the longitudinal grooves suggested by the writer of this treatise, and which the Directors of the Metropolitan Company have adopted.

Mr. Stevens's remarks on the durability of wood-paving, are well worthy of attention:—

A structure of wood, instead of resisting the pressure or percussion of passing vehicles, like such an incompressible substance as granite, yields to it sufficiently to counteract friction, from its inherent property of elasticity. Hence, in Whitehall, where the blocks have been down about two years, they are not reduced in depth the eighth part of an inch, on the average. And this reduction, being more the result of

\* Published by Spencer, Holborn, price 6d.

compression than of abrasion, is not likely to continue, even at that ratio. For the solidity of the blocks is increased, even if the volume be thus very slightly reduced. Indeed, paradoxical as it may at first appear, the traffic which is destructive of Wood Paving in one way, contributes to its preservation in another; and may be thus explained:—the Wood Paving is put down in a comparatively dry state; and if it always were perfectly dry, would be much more susceptible of destruction, from accidental or mechanical, as well as from natural causes. But, soon after it is constructed, it becomes partially saturated from rain and other causes; and continually repeated pressure forces more and more water into the blocks, until every pore is completely filled. In this state, the water assists in supporting super-incumbent weight; whilst it effectually preserves the wood from decay. For, in fact, of the six sides of a block of the given form, only the upper one is exposed to the action of the atmosphere: below the surface, the whole mass is as thoroughly saturated as if it were immersed in water; and the surface itself becomes so hardened by pressure, and the induration of foreign substances, such as grit and sand, as to be impervious to the action of the sun, especially in a northern climate. To the same cause, therefore, greater capability for the resistance of pressure, and preservation from decay, are attributable. And that water is a preservative against decay, is provable in a variety of cases—one may be deemed sufficient. Vessels employed in the timber trade between this country and Canada, are chiefly constructed of pine and beech. Their keels, keelsons, stern-posts, floors, foot-hooks, timbers, and beams, are usually of beech; their bottoms, sides, ceilings, and decks, of pine. After running eight or ten years, it is almost invariably found that decay takes place in the beams, top-sides, and other parts, where but occasionally exposed to moisture; but that all those parts immersed in the water, or kept constantly humid, continue to be as sound as when first converted to their several purposes. Dry rot, therefore, can never affect good wood paving; nor can any other secondary process of vegetation, in consequence of the preservative qualities of water—the shutting out, in short, of atmospheric influence. And it is questionable if, under other circumstances, the incessant vibration to which the blocks are subjected, by traffic, would not have a strong preservative tendency.

There is an impression pretty generally prevailing, that wood-paving is more expensive than the present system of granite pitching. But, so far from this being the case, Mr. Stevens shows in the pamphlet from which we have quoted, and in another intitled "Wood Paving for the Provinces," that the cost is considerably below that of either granite pitching or macadamizing. We are aware that the broken granite and whinstone used for the Metropolitan roads, when all the charges of freight and breaking it into suitable size have been paid, does not cost less than 20s. per cube yard. A stratum of 9 inches in thickness will therefore amount to 5s. per square yard, and, in addition to this first cost, the road will require annually a covering of broken stone, 3in. in depth. This will amount to 1s. 8d. per annum; whilst the Metropolitan Company is ready to lay down wood paving, and to keep it in perfect repair for 14 years, at a cost, including the foundation, of 1s. 4d. per annum, during the whole term of the lease. The saving of expense from adopting wood paving, is considerably more when it is used as a substitute for granite pitching, and as the trials which have already been made in the metropolis prove uncontestedly its superiority in every essential which constitutes a good pavement, we may expect to see the example of the Metropolitan districts followed by every large town in the kingdom. Mr. Stevens recommends for provincial paving, blocks of 4 or 5 inches in depth, those commonly used in London being 6 inches. The Metropolitan Company, of whose system he thinks most highly, adopt a concrete of blue lias lime, gravel, and a metallic sand, which appears to be basaltic, or of the nature of terras. This concrete costs in London about 2s. per square yard, but the price will be less in many districts where a good hydraulic lime, possessing similar properties to the lias, can be procured on the spot.

There is one fact in the practice of wood-paving, which we are informed is of considerable consequence, namely, that the blocks should not be laid down in a highly dried or seasoned state, be-

cause they would then, upon imbibing rain and other moisture, expand to a greater bulk, and the paving, being confined at the sides, would blow up. The practice adopted by the Metropolitan company, is to lay the blocks, which may be either of Scotch fir or Norway pine, in a moist state, shortly after they have been cut, and without subjecting them to any process of seasoning, kyanizing, or creosoting. That everything of this kind is entirely unnecessary in the case of a well-constructed wooden pavement, is evident from the perfectly sound appearance of the blocks, when they are taken up after having been laid many months. Not the slightest growth of fungus, nor any appearance whatever of dry rot, is observable in any of the pavement so examined; its preservation is no doubt attributable in a great degree to the water-tight stratum of concrete on which it is laid. The water with which they are originally charged, in addition to what they imbibe at the surface, keeps the blocks constantly moist, and, when the surface once becomes indurated, as it very soon does by the sand and grit trodden in by the horses' hoofs, there is none of that alternately wet and dry condition which is so favourable to the growth of dry rot.

#### WESTMINSTER BRIDGE.

We are glad to inform our readers that the improvements of this bridge are rapidly in progress. One of the centre piers has just been finished, and the workmen are now engaged in drawing the piles of the coffer-dam, a work of no small labour, as they are from 30 to 34 feet in length. The distance between the inner and outer row of piles in the dam, is 4 ft. 6 in., this space being made water-tight by a filling-in of clay puddle. It is intended to widen the bridge 12 feet, a work so much wanted, that we are only astonished it was not commenced long since: we understand the slope of the approaches on each side are to be considerably reduced, so that much of the inconvenience felt from the heavy draught, and from slipping of horses in frosty weather, will be removed. The foundations of the bridge were repaired some years ago by a diving-bell, but it was found to be in such a dangerous state, that nothing short of a coffer-dam would prove effectual in the present case.

We are glad to be able to bear testimony to the substantial way in which the piers are being repaired. It may be well to mention that each pier has been paved all round, and in order to secure it, beech piles have been permanently driven in outside the paving. The stone employed is brought from the Bramley Fell quarries in Yorkshire. The mode adopted for repairing the arch stones, is similar to that so successfully employed at Blackfriars' Bridge, and described in the Transactions of the Institution of Civil Engineers, vol. i. Half the piers of the bridge have been already extended 12 feet, and, before long, we are in hopes of being able to announce their entire completion. We feel convinced that no unnecessary time (as far as compatible with the stability of the work) will be lost by the contractor, Mr. Cubitt, towards whom it is only justice to state, that we never saw a work executed in a more masterly way, nor one carried on with more of that attention and care which are so necessary in hydraulic operations of this nature."

## SHORT NOTES.

## GRANGE ROAD STATION.

THE want has been long felt of a sufficient station at London Bridge, for the accommodation of the important railways from Brighton and Dover, which use the Greenwich line as their common track. In order to meet this want, the Croydon Railway Company proposes to construct a station for the convenience of the west end traffic, at the place where the Grange Road, Bermondsey, crosses the Greenwich railway. To show how utterly inadequate is the London Bridge station, the Croydon Company makes the following statement :—

Railways.	Length.	Size of Railway Stations.
Brighton	40 miles	
Dover	67	117 miles 2 acres
Croydon	10	
Great Western	118	32½
Birmingham	112	40 { 6 acres Euston Sq.
Southampton	77	6½ { 34 do. Camd. Town

## IMPROVEMENT IN THE USE OF THE DIVING BELL.

DR. PAYERNE's descent in a diving bell, in which he remains for some time under water without any air being pumped in, excites much attention at the Polytechnic Institution. He has gone down on several occasions at 11 o'clock, and remained till 2. The only particulars of the process by which he is thus enabled to produce atmospheric air for his existence during this length of time, are, that he takes with him Smee's voltaic battery, one of small size, and a few phial bottles. A correspondent suggests that he decomposes water by means of the battery, and has some means of getting rid of the hydrogen.

## PROCESS OF TINNING.

IRON plates for culinary purposes are now commonly rolled into the flat thin shape between rollers, in the same way as bars of round, square, or flat iron. The grooves in the rollers are cut in a variety of different shapes, according to the kind of iron they are required to form, whether bars for railways, round, flat, or square bars, boiler plates, plates for making iron vessels, or thin plates for culinary utensils.

These latter are afterwards tinned in the following manner.

Large vessels are filled with a solution of tin in sulphuric acid, which is called pickle. The iron plates are dipped into this pickle, and when withdrawn are found coated with tin, the acid having a stronger affinity for iron, which unites with it, and the tin is deposited on the surface of the iron. The plates are afterwards rubbed and polished.—*Dr. Mitchell's Report on the Iron Works of Staffordshire and Shropshire.*

## INSTITUTION OF CIVIL ENGINEERS.

MAY 31.—A paper was read "On the Construction of Model Maps," by J. B. Denton, in which the author insisted very strongly upon the great advantages possessed by models in relief over plans upon paper, as the former displayed at one view all the capabilities of a district, whether as respects the drainage, the forming of roads or railways, and the improvement of the navigation, also enabling the landed proprietor to examine the state of the agriculture of the spot, as the nature of the soils of the various parts can be shown, and the geological features delineated.

The mode of constructing the models was described, and the expense was stated to be for a model of the line of a railway or canal crossing a parish, £10 per mile; for an estate, from 2s. 6d. to 3s. 6d. per acre.—A model was exhibited, which demonstrated the author's accuracy.

A paper by the Rev. Mr. Clutterbuck was read, intitled "Observations on the Periodical Drainage and Replenishment of the Subterranean Reservoir of the Chalk Basin of London."—The line of the country more particularly treated of is that through which the river Colne passes; part of this district is covered with gravel, through which the rain-water percolates to the chalk, in which it accumulates, until it rises and finds vent by the streams Ver, Gade, Balbourne, and Chess, which are tributaries of the river Colne; the other portion of the district is covered by the London and plastic clays, on the surface of which the rain flows by open drains into the Colne, rendering it subject to sudden floods. In the upper or chalk portion of the district, a periodical exhaustion and replenishment of the subterranean reservoir is continually going on, which has been traced by the author through a series of wells, and found to be exactly in proportion to the distance from the river or vent. A progressive rise takes place between autumn and spring, and a fall between spring and autumn. The sources of several streams have been found to break out higher up; as the water accumulates in the chalk reservoir above a certain level, they seldom run for a long period, as the increased drainage they afford sooner depresses the level. The paper treated at some length on the depression of the water-level beneath London, from which it would appear that the rapidity of the demand exceeded that of the supply. It then stated the depression of the London wells to be during the week about five inches. On Sunday, during the cessation of pumping, the original level is generally nearly resumed. Heavy falls of rain, or extraordinary cessations of pumping, vary this alternation of level; but, as a general rule, the author assumed that the holidays of the metropolis might be known by the relative heights of water in the wells at some distance from it. The paper was illustrated by a series of sections of the rivers, and the district treated of.—A very animated discussion took place, in which Dr. Buckland, Mr. Dickenson, and other gentlemen well acquainted with the subject, added their testimony to the correctness of Mr. Clutterbuck's views.

JUNE 7.—The conversation was renewed upon the subterranean reservoir of water in the chalk basin of London, when Mr. Braithwaite exhibited and explained a model of the well sunk by him far down into the chalk, for the purpose of supplying Messrs. Reid's brewery with water; it appeared that he found the greatest amount of water to proceed from immediately beneath the veins of flints, and not in the body of the chalk, as had been asserted. When the body of the well had been sunk to a considerable depth, several adits, or drift-ways, were driven laterally for considerable distances along the faults and the veins of flints, to collect the water, and convey it to the main shaft, by which means 7700 barrels, of thirty-six gallons each, were enabled to be raised per day, which, if applied to domestic purposes, would afford a supply for 5000 families; full accounts of the expense of sinking the well, &c., were given, and it appeared that Mr. Braithwaite's views coincided with those of the majority present, as to the disadvantages to be anticipated from pumping up a large supply of water from the chalk in Hertfordshire.

A paper was read upon "The Alterations of Tullow Bridge, Ireland," by Mr. Charles Forth. The bridge has been in a dilapidated state for some time, and the approaches were inconveniently steep, the ascent being 1 in 7. The paper gave an account of the substitution of flat arches for the semicircular form, reducing the acclivity to 1 in 40, adding to the width at the same time without building new piers, the whole being done for the small sum of £485. The paper was illustrated by a good drawing supplied by Professor Vignoles, who enlarged upon the ingenuity of the plans adopted in executing the work.

A paper from Mr. Thomas Oldham, the engineer to the Bank of England, gave an account of the method of numbering and dating bank notes by machinery in that establishment, and the improvements introduced upon Bramah's numbering press by his father, the late Mr. John Oldham, and himself. The description was, of course, too technical for general readers; suffice it say, that by these improvements, instead of, as in Bramah's press, producing only units, and bringing round the tens and hundreds by hand, Oldham's press effects numerical progression from 1 to 100,000 with unerring precision.

Mr. Oldham explained, that he had carried the machine still farther, and, by an arrangement of wheels and palls, could continue printing to an unlimited numerical extent, with presses properly constructed. The communication was illustrated by a very beautiful model, which we recognized as having been exhibited at the president's conversations on the previous Saturday evening.

The following papers were announced to be read on Tuesday, the 14th of June:—"On Sinking, Tubbing, or Coffering Pits in the Coal Dis-

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tricts of the North of England," by R. T. Atkinson.—"On Iron Sheathing, Broad-headed Nails, and Inner Sheathing of Ships," by J. J. Wilkinson.

JUNE 14.—A paper was read "On the Sinking and Tubbing of Coal Pits in the North of England," by Mr. Atkinson, in which was detailed, in a very complete manner, the methods adopted for sinking the pits down to the coal through sand, water, and perishable rock, demanding the most extraordinary precautions; and, even when they are so sunk, the weight of water lifted by the pumping engines amounts, in many instances, to more than four times that of the coal brought from the mine; for instance, at the Percy Main Colliery, the water drawn per day equals 3922 tons, while the weight of the coals raised in the same time only amounts to 636 tons. The power employed to perform this work is very considerable, and the most incessant care is demanded to prevent accidents. All the precautions to be taken were very accurately described, and illustrated by a large series of drawings and models. The details of the sinking of several peculiarly difficult shafts were given, and the opinion of the author's uncle, Mr. Buddle (who is the best authority in these matters), were quoted as to the soundness of the methods recommended. The paper appeared of a very valuable character, and although too long for reading to a mixed assembly, will be of great value to the profession, as it is evidently the work of a person well versed in the subject on which he has written.

The paper by Mr. J. J. Wilkinson, "On Iron Sheathing, Broad-headed Nails, and Inner Sheathing for Ships," was the termination of the series commenced during the last, and carried into the present session; it contained many valuable facts on the various points, and an elaborate list of patents connected with shipping, which will, no doubt, be very useful for reference.

JUNE 21.—A paper by Mr. C. Hood was read, on some peculiar changes in the internal structure of iron, independent of, and subsequent to, the several processes of its manufacture, which broached boldly an original view of the causes of fracture of railway axles, and hence the causes of many serious accidents on railways. It was contended that any bar of iron, even of the most fibrous and tough character, being subjected when cold to percussive action, would assume a crystallized texture, and eventually break; that this would be materially hastened by the effects of partial heat and magnetism; that the effect of vibrations is most sensibly felt in the immediate proximity of the cause of it; that thin tough and fibrous character of wrought iron is produced by art, and in all the changes that have been described we see an effort at returning to the natural and crystalline structure common to a large number of metals; and that the rotating of railway axles renders them peculiarly subject to this influence. The arguments were illustrated by many practical examples and specimens of iron broken under various circumstances, and the general conclusion arrived at, appeared to be, that there is a constant tendency in wrought iron under certain circumstances to return to the crystallized state; that this crystallization is not necessarily dependent upon time for its development, but is determined by other circumstances, of which the principle is undoubtedly vibration; that heat, although it assists, is not essential to it, but that magnetism, whether induced by percussion or otherwise, is an essential accompaniment of the phenomena attending the change. Many other considerations were adduced, such as the rigidity of the carriages, the looseness of the axles in their brasses, &c.; and in the discussion which ensued, the question as to the amount of change in texture which was produced during the process of manufacture by hammering was fully debated, and a material improvement in railway axles, by making them hollow from two rolled skelps, and welding them along the sides in swages at one heat, under the patent by Mr. York, was described and exhibited to the meeting.

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#### CLAUSES IN THE BILL FOR REGULATING BUILDINGS IN LARGE TOWNS.

(AS AMENDED BY THE COMMITTEE OF THE HOUSE OF COMMONS,  
27TH MAY, 1842.)

And be it enacted, That it shall not be lawful to build within the limits of this act any house in which the floor of any room or cellar to be used as a dwelling, shall be      feet below the surface or level of the ground in the immediate neighbourhood of such house, unless there shall be an area not less than three feet wide from the floor of such room or cellar to the top of the area adjoining to the front or back of such room or cellar, and extending from one side or party wall to the other side or party wall, which area shall be either open or covered with an iron grating, of which the bars shall not be less than one inch asunder; but this

enactment shall not be taken to prevent any archway or covering which may be laid across such area for the purpose of approaching the doorway of the house.

And be it enacted, That in any house to be built within the limits of this act after the passing thereof, it shall not be lawful to let separately, except as a warehouse or storehouse, or to suffer to be occupied for hire as a dwelling-place, any underground cellar or room not having a window and fireplace, as well as such an area adjoining thereto as is hereinbefore specified.

And be it enacted, That it shall not be lawful to build any new street, alley, or public passage within the limits of this act, except such as were begun or laid out before the passing of this act, under the authority of any act of parliament, unless the houses therein shall be separated by at least thirty feet where there is a carriage-way between such houses, or at least twenty feet in the case of alleys and foot passages where there is no carriage-way.

And be it enacted, That the level of the ground floor of every house which shall be built within the limits of this act shall be at least six inches above the level of the footway or road adjoining such house.

And be it enacted, That no room which shall be built within the limits of this act to be used as a dwelling on the cellar or ground floor, or elsewhere than in the upper story of any house which is not higher than forty feet, or which does not contain more than five squares of building on the ground floor, shall be less than eight feet in height from the floor to the ceiling, and no room in the upper story of any such house shall be less than seven feet in height from the floor to the ceiling.

And be it enacted, That there shall not be more than one story in any part of the roof of any house or other building which shall be built within the limits of this act.

And be it enacted, That no house which is not higher than forty feet, or which does not contain more than five squares of building on the ground floor, except houses in a street or thoroughfare which was begun or laid out before the passing of this act, under the authority of any act of parliament, shall be built within the limits of this act without a privy, with proper doors and coverings to the same, either in the house or in some sufficiently convenient place set apart for the purpose, and sufficiently screened and fenced from public view, to the satisfaction of the Surveyor of the district.

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#### REPORT ON THE CALEDONIAN CANAL.

THE Select Committee appointed to examine the Report of Captain Sir W. E. Parry, R.N., on the Caledonian Canal, and to report their observations and opinion thereon to the House, and to whom the reports of sessions 1839 and 1840 were referred, and who were empowered to report the minutes of evidence taken before them to the House—have considered the matters to them referred, and have agreed to the following Report:

Your committee having had under their consideration the Report of Captain Sir W. E. Parry, and the reports of the Select Committees appointed in 1839 and 1840, to consider and report to the House what steps it is advisable to take with respect to the present state of the Caledonian Canal, are of opinion that it would be highly inexpedient to allow the works of the canal to remain longer in their present insecure state, and that it is necessary that parliament should, without delay, come to some determination with regard to them.

The very full information contained in the evidence of the former committees, and also in the able report of Sir W. E. Parry, render it unnecessary for your Committee to enter into any detailed statement of the dangers to which the works of the canal, and the adjacent country, are at present exposed; and they will therefore very briefly state the different courses which may be taken to obviate these dangers; viz.:

1st. To execute only those works which are absolutely necessary, the expense of which is estimated at £25,000.

2nd. In addition to those works, to improve the navigation of the whole line of the canal, and to establish five steam tugs, the expense of which has been estimated at £150,000.

3rdly, To abandon the canal altogether, in which case the expense is estimated at £40,000.

Your Committee are of opinion, that it would not be expedient to adopt the first of these plans, as no additional facilities would be thereby afforded to vessels passing through the canal, and no increase of traffic could therefore be calculated upon.

Owing to the imperfect state of many parts of the canal, and the insufficient depth of water, especially during the summer months, the naviga-

tion is frequently interrupted, and the length of time for which vessels have occasionally been detained in passing through the canal has hitherto prevented it from being so extensively used as there is no doubt it would be, if these obstructions were removed. The amount of dues which have been hitherto received is not sufficient to defray the annual expenses of the necessary repairs and establishment, and no return could therefore be expected for any additional expenditure limited to the works above alluded to.

If therefore the canal is to be maintained, your Committee have no hesitation in recommending that measures should be taken, with the least possible delay, for carrying into effect the more extended plan set forth in Mr. Walker's Report of 1839, by which great additional facilities will be given to trade, by the establishment of steam-tugs, and the other measures therein contemplated.

The evidence which has been given, both before the former committees and on the present occasion, shows that there is every reason to believe that if these improvements were executed, the trade on the Caledonian Canal would increase to such an extent as to afford a fair return for the money which they would cost.

Sir E. Parry has shown in his Report (p. 8), that there would be so great a saving on insurance, and on the wages and victuals of the crews, and wear and tear of the ships using the canal, in preference to the passage north about, that the present dues might safely be doubled.

Your Committee beg leave to refer to his able Report for the reasons on which he forms the opinion, that the canal, if placed in a proper state of efficiency, as recommended by Mr. Walker, could not fail to add materially to the facilities for carrying on a large and valuable portion of the trade of the country.

Your Committee have examined Mr. Walker, and Mr. May, the resident engineer of the canal, with regard to the probable expense of abandoning the canal altogether, and restoring the waters of Loch Lochy to their original level, which appears to your Committee to be the only other course, if Parliament should not be inclined to sanction the expense for placing the canal in an efficient state.

Mr. May states his opinion, that a sum of £50,000 would be required for this purpose. Mr. Walker thinks that some savings might be made on Mr. May's estimate, as he does not consider all the works included in that estimate to be indispensably necessary. His opinion, however, is, that the expense could not be below £40,000.

It appears from the statement of the debt due from the Commissioners of the canal, as furnished to your Committee by Mr. Smith, the secretary to the Commissioners, that there is owing to the Bank of Scotland, and to the several proprietors of land on the line of the canal (including the interest due there) a sum not less than £31,568, to meet which it is necessary that funds should be provided, in addition to the sum required for the execution of any of the above-mentioned plans.

The total sum required, if the canal is to be altogether abandoned, including the extinction of the present debt, cannot be taken at a less sum than £91,568.

The expense of placing the canal in a complete state of repair and improved efficiency, including the debt, may be taken at £201,568.

Upon a full review of all the circumstances of this case, as now brought under the consideration of your Committee, though they may entertain great doubts of the expediency of undertaking this work originally, and though it is impossible to expect that it ever can afford any adequate return for the expense already incurred, they are nevertheless unanimously of opinion that it would not now be advisable to abandon this great national work at an additional sacrifice of £91,568, when from the evidence submitted to them it appears, that by the outlay of a further sum of £110,000, the obstacles which have hitherto impeded the navigation of the canal would be completely removed, and such an increase of trade might be expected as would justify this heavy expense.

Your Committee have therefore, in accordance with the opinions expressed by the Select Committee of 1839, come to the following resolutions:—

1. That this Committee fully concur in the resolutions agreed to by the former committee of 1839 (page 8), which have been confirmed by the Report and recent examination of Sir E. Parry.

2. That your Committee are of opinion, that the necessary steps should be taken without delay to carry into effect these recommendations.

In conclusion, your Committee beg leave to call the attention of the House to the present constitution of the Board of Commissioners, and to suggest whether it would not be expedient to make such alterations therein as might secure a regular and efficient superintendence of this important work.

2nd May, 1842.

#### THE AXLES OF LOCOMOTIVE ENGINES.

The accident on the Versailles Railway, by the breaking of the front axle of a four-wheeled locomotive engine, having given rise to some difference of opinion as to what would be the effect of a broken front axle of the four-wheeled engines used in this country on the London and Birmingham, the Eastern Counties, the North Union, and other railways using this description of engine, the London and Birmingham Railway Company, with their usual liberality, undertook some experiments for this purpose. The object was to ascertain the effects of a broken fore-axe, and whether anything could be suggested from these effects which could increase the public safety. As no front axle of this kind of engine had ever been known to break, it was determined to cut one, so as to insure its breaking. Accordingly, a few days since, the fore-axe of one of the ordinary passenger engines was cut nearly through its entire thickness, at a short distance from one of the bearings, as being the most severe test, and was started from Wolverton without any load. The engine ran eight miles, and it was then examined, and the axe found to be broken quite in two. The engine was then crossed over to the other line of rails (passing through the points) and returned back to Wolverton without any accident whatever. The next day the engine, precisely in the same state in which it had been left on the preceding day, was started from Wolverton with a train of six loaded luggage-trucks attached, weighing about 35 tons, and it proceeded, without stopping, to Watford, a distance of 34 miles. At this time the speed was about 25 miles an hour, when one of the four wheels slipped inside the rails, but the engine exhibited no signs of breaking down. The wheel was replaced on the rail, and the engine again started and ran 12 miles further, when one of the fore-wheels and both the driving-wheels slipped off the rails, and the engine ran 200 yards over the cross sleepers, but without the slightest indications of breaking down. The wheels were again replaced on the rails, and the engine then ran safely to Camden Town—a distance of 52 miles, which it accomplished in three hours and a half, including all the time lost in twice replacing the wheels on the rails. The total distance run by the engine after the axe was broken quite through, was upwards of 60 miles, and the experiment is considered to afford the most satisfactory evidence of the perfect safety of the four-wheeled engines, when made with inside bearings. The fracture of the crank axles of these engines, has several times been proved to be perfectly harmless, as instances have occurred, of four-wheeled engines running seven miles with a broken crank axle; while it is said that six-wheeled engines are immediately disabled under similar circumstances.—*Times*.

#### FRESCO PAINTING.

MANY have been the struggles of unaided geniuses in this country, to sow the seeds of pure taste and sound judgment in the fine arts, even at the sacrifice of private interest, and in opposition to the full tide of prejudice and discouragement. Barry, Fuseli, Flaxman, Stothard, and Hilton, are examples of this; and though their conceptions would have adorned any age, they were suffered to pass through life without a single national commission; or any work of sufficient scope to elicit fully the high powers they possessed.

Public and private bodies have likewise exerted their influence in cultivating a love and just appreciation of the powers of intellect; but to little purpose are institutions formed, or even premiums awarded, where there is not patronage for that character, or class of art, that can alone dignify a nation, or be profitable to its manufactures. A more general desire, however, is at length awakened, to vie with and rival other lands that have acquired fame and wealth by their works; and the most effectual means of establishing the arts in their highest principles and pretensions, has at length been resorted to, in the appointment of a commission to introduce into England the masterly practice that is raising into fame the schools of Germany and France, namely—Fresco Painting; a medium justly characterized by Fuseli, as "the real instrument of history," and which Vasari describes, as "truly the most virile, most sure, most resolute, and most durable of all modes."

Among the advantages of Fresco for mural decoration, are the absence of glare, with exceeding purity and freshness of colour. Fresco reflecting, instead of absorbing light, renders it particularly beautiful by candle-light, though its bland mellowness of tone is at all times very charming.

The judicious disposition of subjects on the walls of a building is highly necessary to the beauty of the whole. A succession of large compartments should be relieved by pilasters or ornament. If paintings are too close to each other, the eye has no relief, and one is injurious to the next.

## THE SURVEYOR, ENGINEER, AND ARCHITECT.

Where there is sufficient space, the compositions can hardly be too large, the grandeur being greatly heightened by the size, as in "The Hall of Constantine," in the Vatican. The chaste personification of "Justice" and "Benignity," are fine contrasts to the tumult of "The Battle of Constantine and Maxentius." Large historical pictures in fresco or encaustic should occupy the centres of a spacious apartment, smaller ones may then be disposed to advantage; but a number of smaller ones diminish apparently the size of the room. A simple arrangement of ornament, so as to unite the sequence of historic or epic subjects, is essential to the general effect; and the artist should, as Architect and Sculptor, as well as Painter, consider the disposition of several parts. The great mural painters combined the three-fold power, and thus acquired a superiority in arranging extensive works which the simple practice of one of them does not afford. In modern times, Sculptors and Architects in general have little regard for what is pictorial, and Painters are not at all interested in what is architectural, and while the Italian rose in the united strength of the three, the Artist of this day thinks nothing is to be derived from any branch but the one he owns.

The principal works of the renowned Italian Masters are in fresco, and they, as Reynolds observes, "are justly considered as the greatest efforts of art which the world can boast."

Michael Angelo, Raffaelle, Giulio Romano, Corregio, and the three Carracci, Guido, Domenichino, and Guercino, were all eminent in fresco, and far surpass in this material their pictures in oil, simply because the former developed the higher principles.

The Germans, in our own times, have advanced through the same practice, and have acquired, within a few years, fame throughout Europe. They excel in drawing and design; but, which is quite enigmatical, have selected Francia and Perugino for their models, instead of the unaffected grandeur of the Roman school. Still the adoption of fresco is a happy omen, and cannot fail to enlarge the taste of the Germans. There are even now proofs of extraordinary excellence to be seen among them by rising artists, whose genius is overlooked in the present unsound gusto founded upon early art.

For large mural works, the palm must be awarded to fresco by unprejudiced and intelligent minds. The beauty of this medium is so chaste, its tones so purely historic and so void of any meretricious admixture, that though its pretensions are not so numerous as oil, its qualities for the grand style are infinitely superior.—*Latilla on Fresco Painting.*

## MISCELLANEOUS.

**THAMES TUNNEL.**—The *Railway Times* states that a railway on the atmospheric principle is about to be laid down in the Thames tunnel.

**RAILWAYS.**—We understand there is every reason to believe that, in the September of 1843, both the Leeds extension and Liverpool junction lines will be completed; the chain of railway communication will thus have its last link added, and railways will be open in one continuous line, from the River Humber to the Mersey; from the Thames to the Forth and the Clyde; while all the great towns of Great Britain—London and Bristol, Birmingham, Liverpool, Manchester, Leeds, and Hull, Glasgow and Edinburgh, will thus be placed in closer connexion and more rapid communication with each other.—*Doncaster Chronicle.*

**NOVEL AND IMPORTANT IMPROVEMENT IN RAILWAY WHEELS.**—Amongst the many improvements in this department of national wealth, we are informed of one recently patented by Mr. Thomas Banks, engineer, of Manchester, which bids fair to enhance the safety of the travelling public, and also to effect a considerable economy in the expenditure of Railway Companies. This invention consists in a simple and effectual method of manufacturing or renewing the working surface of that most important article in railway transit, the tyre of the running or travelling wheel, and is accomplished by the application of steel to the peripheries of either old or new wheels, in such a manner that increased durability is insured at an inconsiderable cost in the first production, and a permanent economy in the ultimate result, when contrasted with the best wheels now generally employed. The experimental performance of 6,000 miles of such improved construction of wheels, have satisfied the directors of an extensive railway in the north, of the vast importance of the invention, as no visible wear has been found upon the surface of the tyres, although under the severe test of a break-carriage.—*Railway Times.*

**STEAM NAVIGATION ON THE DANUBE** has increased very much during the last year. The number of passengers carried in 1841 was 170,078, the amount of merchandise 513,575 quintaux, which is 44,783 more passengers than in 1840, and 144,943 more quintaux of merchandise. Only a few years ago this great means of communication between the West and

East of Europe was wholly destitute of vessels, and we may anticipate still more rapid advances, and more extraordinary change when the Rhine and the Maine shall be united to the Danube and the Black Sea by the Louis Canal, which is making in Bavaria.—*Impartial (Smyrna Journal).*

**WATER ELEVATOR.**—Mr. Walker, in the course of an explanation lately given by him of his Patent Water Elevator, at the Society of Arts, stated that the principal of action is momentum. It is simply a pump barrel or tube, fitted with a common spindle-valve, opening upwards, near its lower extremity; the lower end of the tube being immersed in the water, a reciprocating vertical motion, of very short range, and of considerable velocity, is communicated to it by attachment to a short crank. The quick motion is produced by connecting a small drum on the crank-shaft with the large driving-wheel. The up-stroke of the tube having communicated momentum to the water within it, the tube is suddenly forced downwards, before the upward motion of the water is destroyed by gravitation; an additional quantity is admitted through the valve, and, when the tube is filled, the water is discharged in a continuous stream from the upper end, which is curved for the convenience of delivery. Oats and other solid bodies were drawn from the well by the pump, and delivered with the water in large quantities. The object of this experiment was to show that, as it is very difficult to choke this machine, it is particularly adapted to the purpose of a ship's pump.

**GYPSUM.**—In order to form a conception of the effect of gypsum, it may be sufficient to remark that 110lbs. of burned gypsum fixes as much ammonia in the soil as 6,880lbs. of horse's urine would yield to it, even on the supposition that all the nitrogen of the urea and hippuric acid were absorbed by the plants without the smallest loss, in the form of carbonate of ammonia. If we admit with Boussingault that the nitrogen in grass amounts to one-hundredth of its weight, then every pound of nitrogen which we add increases the produce of the meadow 100lbs., and this increased produce of 100lbs. is effected by the aid of a little more than 4lbs. of gypsum.—*Liebig's Chemistry.*

**PHOSPHORITE.**—In the report of the Royal Agricultural Society of England, just published, it is stated that Dr. Daubeny of Oxford, has undertaken a journey to Estramadura, in Spain, for the purpose of ascertaining the circumstances and extent of the geological formation or mineral vein of phosphorite, or native phosphorite of lime, which is found in the province and nowhere else, and which is expected to prove of great value in agriculture, as a substitute for the earthy part of bone manures, which it greatly resembles in its chemical composition. A quantity of this phosphorite was imported into Liverpool, some little time ago, from Estramadura, for certain chemical purposes; and we are informed by the gentleman by whom it was imported, that he entertains no doubt as to its applicability to the same purposes as bone manure. The expense of importing it will depend, in a great measure, upon the cost of carriage from the mines to the nearest seaport.

**DETERIORATION IN THE PROPERTIES OF IRON.**—In a discussion on the advantages of four and six-wheeled engines, by the Paris Academy of Sciences, it was stated M. Savart had determined, by careful experiments, that in the course of time the most fibrous metals passed into the crystalline state, and that this transformation was the more rapid the more frequent and energetic the vibrations to which the pieces of metal were subjected. A hundred times (added the author of the letter) it has occurred to me, that at epochs more or less distant from the time of construction, chain-bridges would break, and from no other cause than the frequency of the vibrations of the chain-bars.

**VOLTAICO-ELECTRICAL EXPERIMENTS IN THE SERPENTINE RIVER.**—It had, heretofore, been imagined that aquiform fluids, such as water, and the denser solid earths, had neither of them the capability of acting as conductors of electricity, and re-conducting it to the battery after its passage. Dr. Franklin having tried the former, sought to convey the electric matter down two rivers in America, and to regain the voltaic fluid at the point where the battery was erected, but after sedulous experiments, found it ineffectual. This, however, the two experiments of Thursday completely determined to be practicable, and Messrs. Wright and Bain, of the Polytechnic Institution, who are the operators and discoverers, having obtained permission of the Duke of Sussex to experiment on the broad sheet of the Serpentine river, they completely demonstrated the truth of their experiments to a number of scientific gentlemen, among whom was Mr. Herapath and others. The method of operation was thus. Near the house of the Humane Society, on the right hand of the river, was stationed a small voltaic battery, to which one end of two copper wires were affixed by the hands of the experimentalist, the remaining portion of the wires being conveyed, the one to the left, and the end just immersed in the water, and the other in like manner carried along the right path of the river up to the bridge which divides the park from Kensington-gardens; the end of this latter wire was then

permitted to drop into the water over the bridge, on the top of which part it was attached to a coil of wire and needle. The purport of the experiment was to show, that after the wire had been charged with voltaic electricity, that fluid passed out from the ends of the wires and travelled through the whole intervening length of the Serpentine-water, a space of nearly a mile in length, returning to the battery it had set out from, and thereby completing a concentric circuit of about two miles and a half. The needle above-mentioned, situated on the bridge as a test, abundantly proved, by its deflections, the genuineness of the experiment, and signal-flags stationed at that point, and communicating with another in a boat down at the other end of the river, demonstrated by their motions, the velocity with which the aqueously-conducted electricity travelled. A second experiment, made upon parallel wires, extended across the Serpentine, was equally felicitous in its proofs and results.

**IMMENSE STONE.**—The largest stone which we believe has ever been cut out from any of the fine freestone quarries which abound in our vicinity, has been this week removed from the Duke of Buccleugh's quarry at Grantou. It is a block of thirty tons weight of liver-rock, and is intended to form the statue of Lord Nelson, about to be erected in Trafalgar-square, London. It was yesterday removed from the quarry to Graniton-pier, to be shipped in a vessel sent down specially by the Admiralty for the purpose of conveying it to London. The labour of removing it from the quarry was great in proportion to the ponderous mass, but under the superintendence of skilful engineers was satisfactorily accomplished. The cost of the block, with the expense of placing it in Trafalgar-square, we have been told, will exceed 300*l.*—*Caledonian Mercury.*

**COLLIERIES IN LANCASHIRE.**—From a statistical statement of trade, &c., in Lancashire, we learn that there are 330 collieries in that county, employing, when in full work, about 1400 persons; the yearly consumption of coal by all the steam-engines is estimated at about 3,000,000 tons.

**ON PREVENTING THE CRYSTALLIZATION OF IRON.**—An interesting paper was read at a late sitting of the Paris Academy of Sciences, by M. François, an engineer of mines, on the means of preventing the crystallization of iron used in machinery. On the examination of the ruptured axle of the engine which was the cause of the late calamity on the Verrasses Railway, the conclusion came to was, that the rupture had been caused by this crystallization, the iron being of the best quality, and of a volume more than sufficient for the purpose to which it was applied. Similar results on other railways have been ascribed to the same cause; but no person has been successful in the means of preventing the recurrence of accidents by an improved mode of manufacturing the iron, and all that could be done by way of precaution was, not to permit iron axles to remain in use for so long a period as to undergo the crystalline change, which is so fatal, and of which external appearances give no indication. M. François informs us, that, in a long-continued series of experiments, he has observed that a magnetic action upon iron, when in a state of fusion, will produce the change alluded to, causing the small and closely-adhering grains to crystallise into coarse and larger grains, depriving it of its compact character; and it is inferred, that the action of heat upon axles employed in machines, subjected to great velocity, will produce the same effect. This can only be prevented by diminishing the volume of silicate in the iron, by carefully sweating the coal employed in melting, and, above all, by the use, in the manufacture of axles, of iron which has already undergone a partial change in its vitreous character, and which, on being reworked, is much less susceptible of crystalline change than new iron.—Another communication on the same subject, by Colonel Aubert, was also read. He agrees with M. François as to the cause of the imperfection complained of, but appears to think that the only real precaution is, to change the axles employed in railway locomotives so frequently as not to give time for them to undergo the crystalline change, which is found to be so destructive.

**KILLAMARSH CHURCH NEAR SHEFFIELD.**—An attempt is now making to raise a subscription for the rebuilding and enlargement of the parish church at Killamarsh, which we hope will be crowned with success. A vestry meeting was held on the 1st of June, when unqualified approbation was expressed of a very beautiful plan for the new church, which had been furnished by Messrs. Weightman and Hadfield, architects of Sheffield, who estimate "the cost of completing the church (to seat 390 persons) and all fittings, using the old materials where that can be done, at £1200." The following is a part of their report:—"And we hope that the work when finished, will bear about it sufficiently correct feeling to escape the just reproaches that have been heaped upon the church manufacturing of the nineteenth century."

**NEW WESLEYAN CHAPEL AT BARNESLEY.**—We understand that the very princely sum of £3000 is already subscribed towards building a new chapel for that body at Barnsley, the site for which is not yet determined upon.

**CONSECRATION OF ARDSLEY CHURCH.**—His Grace the Lord Archbishop of York consecrated the new church at Ardsley, near Barnsley, built under the superintendance of Messrs. Hurst and Moffat, Architects, Doncaster, on Tuesday, June 7. Divine service has been performed in it nearly twelve months.

**NEW CHURCH AT OUGHTHYBRIDGE.**—The first stone of a church to be erected at Oughthybridge (near Sheffield) was laid on Wednesday the 22nd. This place of worship will be a great accommodation to the inhabitants of this portion of the extensive parish of Ecclesfield—parish which we believe is equal in area to the whole county of Rutland. We understand the architect for the church is Mr. Mitchell of Sheffield, and that the amount for the building fund does not exceed £1500. We fear that with so small a sum the church will be far inferior even to the Bethnal Green churches.

**BLYTHE.**—A new school is in the course of erection, for the purpose of educating female children on the National School system.

#### LIST OF PATENTS.

*Continued from page 160.*

#### (SIX MONTHS FOR ENROLMENT.)

William Young, of Queen Street, London, lamp maker, for "improvements in lamps and candlesticks."—Sealed May 28.

Philip Jacob Kayser, of Gracechurch Street, manufacturer, for "improvements in the construction of lamps."—Sealed May 31.

Henry Philips, of Exeter, chemist, for "improvements in purifying gas for purposes of light."—Sealed May 31.

Richard Watson, Jun. of Cloth Fair, gas fitter, for "improvements in draining land embankments and cutting of railways and other engineering works."—Sealed May 31.

Henry Wilkinson, of Pall Mall, gun maker, for "improvements in loading shipping, especially those called colliers."—Sealed May 31.

Louis Nicolas de Meckenheim, of Vienna, but now of London, engineer, for "improvements in the manufacture of iron."—Sealed May 31.

Henry Beaumont Leeson, of Greenwich, doctor of medicine, for "improvements in the art of depositing and manufacturing metals and metal articles, by electro-galvanic agency, and in the apparatus connected therewith."—Sealed June 1.

William Henry Kempton, of South Street, Pentonville, gent., for "improvements in the manufacture of candles."—Sealed June 1.

James Reed, of Bishop's Stortford, statuary and mason, for "improvements in tiles, slating, and the construction of water-tight joints, and in the covering and casing of buildings and other erections."—Sealed June 2.

Henry Jubber, of Oxford, confectioner, for "certain improvements in kitchen ranges and apparatus for cooking."—Sealed June 2.

Benjamin Aingworth, of Birmingham, gent., for "certain improvements in the manufacture of glass, for the purpose of producing glass which may be used for the purposes to which plate glass and window glass are usually applied."—Sealed June 4.

Edmund Tuck, of the Haymarket, silversmith, for "certain improvements in the covering or plating with silver various metals and metallic alloys."—Sealed June 4.

William Irving, of Regent Street, Lambeth, for "an improved corn drill or machine for sowing all kinds of seed or grain."—June 7.

John Woodcock of Manchester, millwright, for "certain improvements in the construction of steam engines."—Sealed June 7.

James Nasmyth, of Patricroft, near Manchester, engineer, for "certain improvements in machinery or apparatus for forging, stamping, and cutting iron and other substances."—Sealed June 9.

Charles Searle, of Bath, gent., for "improved preparations of tea, coffee, cocoa, and milk."—Sealed June 9.

Joseph Chatwin, of Birmingham, lamp maker, for "certain improvements in the construction of cocks."—Sealed June 9.

John George Hughes, of 158, Strand, general agent, for "a new application of telegraphic signals, and the mode of applying the same."—Sealed June 9.

James Anthony Emslie, of the borough of Newcastle-upon-Tyne, civil engineer, for "certain improvements in pumps."—Sealed June 9.

Stephen Bencraft, of Barnstaple, gent., for "improvements in the construction of saddle trees."—Sealed June 9.

Arthur Howe Holdsworth, of Brook Hill, Devon, gent., for "improve-

ments in constructing certain parts of ships and vessels in order to arrest the progress of fire, and for regulating temperature."—Sealed June 9.

Richard Garrett, of Leiston Works, Suffolk, agricultural implement manufacturer, for "improvements in the construction of horse hoes, scarifiers, drags, rakes, and drills, for cultivating land."—Sealed June 13.

Thomas Banks, of Manchester, engineer, for "certain improvements in the construction of wheels and tyres of wheels to be employed upon rail-ways."—Sealed June 13.

Moses Poole, of Lincoln's-inn, gent., for improvements in obtaining the colouring matter from wool and woollens dyed with indigo," being a communication.—Sealed June 13.

William Cotton, of Leytonstone, Essex, for "an improved weighing machine."—Sealed June 13.

Daniel Williams, of Oxford, slater, for "improvements in covering ridges and hips of the roofs of buildings."—Sealed June 13.

William Morrett Williams, of Fenchurch Street, lock manufacturer, for "certain improvements in the construction of locks and keys, which he proposes to call 'Williams's lock and key improved.'"—Sealed June 13.

Henry Hough Watson, of Bolton le Moors, chemist, for "certain im-

provements in bleaching, changing the colour of, and otherwise preparing, purifying, and refining tallow and certain other organic substances, mixtures, compounds, and manufactures."—Sealed June 21.

Joseph Bunnett, of Deptford, engineer, for "certain improvements in pavements for streets, roads, and other surfaces, and in machinery for producing and repairing the same."—Sealed June 21.

John Dickson, of Brook Street, Holborn, engineer, for "improvements in rotatory engines and boilers, in stopping railway carriages, and in machinery for propelling vessels, part of which improvements are applicable to propelling air and gases."—Sealed June 21.

Frederick Gye, jun., of South Lambeth, gent., for "improvements in binding pamphlets, papers, and other documents."—Sealed June 21.

Thomas Gaunt, of Dalby Terrace, City Road, gent., for "improvements in the means of applying any such power as is or may be used for propelling vessels or carriages to produce locomotion thereof."—Sealed June 21.

Henry Bewley, of Dublin, licentiate apothecary and chemist, for "an improved chalybeate water."—Sealed June 23.

#### TO CORRESPONDENTS.

"**ALPHA.**" We should recommend a young architect, while yet a pupil, to employ his leisure hours, that is to say, the time not occupied either in the office, or in necessary recreation—in the study and observation of the best architectural examples, both in actual construction and in books. It would be invidious on our part to point out a series, either of books or of actual works, as the best worthy of study and imitation; but the pupil cannot fail to receive information of this kind, from those with whom he is more immediately in connexion, for the purposes of instruction.

"**A YOUNG ENGINEER.**" There is no general engineering dictionary such as our correspondent inquires for. Such a work, if properly compiled, would be exceedingly useful, as new terms and new adaptations of technical words are constantly springing up. We have known even experienced contractors somewhat puzzled to make out some of the terms used in modern specifications. Our correspondent is, probably, aware that there is a book termed 'A Glossary to Brees' Railway Practice,' but this work, not being the production of a practical man, cannot be depended on, even with respect to the terms used in railway engineering.

In sections of roads and canals there is no standard for the proportion of the vertical to the horizontal scale. These must depend upon the object for which the section is laid down, and upon the extent of detail required to be shown. A very common scale for the working section of a railway, is that of 4 chains to an inch, horizontal, and 20 feet to an inch, vertical: so that the vertical scale here, is  $13\frac{1}{2}$  times the size of the horizontal.

The minimum scales required by the standing orders of parliament for roads, railways, and canals, are that of one mile to 4 inches, horizontal; and 100 feet to an inch, vertical. In these two scales, also, the vertical is  $13\frac{1}{2}$  times the size of the horizontal; an exact co-incidence with the proportion between the scales we have mentioned for large sections. It may be observed, as a general rule, that where it is intended to disguise or conceal the prominences and irregularities of the surface, the horizontal scale should be longer, or the vertical scale smaller than in the above projection; and, on the other hand, where it is intended greatly to exaggerate the inequalities of the surface, the horizontal scale should be smaller, or the vertical scale greater.

The proportions given above will be found useful and convenient for ascertaining quantities from the sections.

"**AN ENQUIRER**" asks, What method is the best and most expeditious for enlarging and reducing plans? This may either be done by the pentagraph, or by the method of squares. The former is the most expeditious, but the latter is probably the most correct, unless the pentagraph is used by skilful hands. For a more detailed answer to this question our correspondent may consult any modern work on surveying.

What scales for surveys of estates and farms, have been in general use in England before the commencement of the Tithe Survey? Scales of 12, 10, 8, 6, 5, 4, 3, 2, and 1 chain, to an inch, have always been used by surveyors according to the kind of survey. For an open district, entirely rural, one of the small scales would be sufficient where it was not required to measure quantities from the map. For towns and very small enclosures, one of the large scales should be used, such as 2 chains to an inch, 1 chain to an inch, or 2 chains to an inch and a half. The tithe surveys made no innovation with respect to the scales in general use. The 3 and 4 chain scales are recommended in Captain Dawson's Report to the Tithe Commissioners, and they are the best that can be used for the original plans of rural districts. Copies may be made on a smaller scale according to the purpose for which they are required.

\* \* \* In consequence of Mr. Mudie's death, the SURVEYOR, ENGINEER, AND ARCHITECT, has passed into different hands. The work will appear as usual on the first of every month; the editorial department is conducted by an engineer and an architect. It is requested that all books for review and communications may be sent to the Publisher's, on or before the 20th of the month. Those relating to architecture should be addressed "To the Architectural Editor," and those relating to all other subjects "To the Engineering Editor."